ARMOURED RECONNAISSANCE VEHICLE БРДМ-2

Maintenance Manual

C O N T E N T S

Part II

OPERATING INSTRUCTIONS

I N T R O D U C T I O N

The present Manual contains information required for proper operation of the БРДМ-2 armoured reconnaissance vehicle and for maintaining it in constant readiness for use.

Part I of the Manual describes the construction of the vehicle and includes instructions on care and adjustment.

To make the use of the Manual more convenient, instructions on service adjustments and care of various units, assemblies and mechanisms of the vehicle are given alongside the description of the corresponding items.

Questions pertaining to construction and maintenance of armament, instruments, communication facilities and some other special items of the equipment are briefly discussed in this Manual. More thorough information may be obtained from the special instructions issued by the Manufacturing plants where the equipment elements are produced.

Part II of the Manual contains instructions on operation of the vehicle. It includes engine starting and shutdown procedures, control of its operation, driving techniques under various conditions, detailed description of maintenance operations and the Lubrication Chart.

It should be noted that for proper running of the vehicle the using arms personnel must make use of all the service papers given in the List of Standard Equipment of the vehicle in addition to the present Manual.

W A R N I N G

The vehicle may be operated only by a driver having the driving license after he has studied the present Manual and passed the driver's examination on the БРДМ-2 vehicle.

While operating the vehicle, the driver must observe the following:

1. The coolant should be drained through three cocks (of heat exchanger, starting preheater and heater). When draining the coolant from the system the cap of the expansion tank should be open.

2. It is impermissible to cut the storage battery from the vehicle mains when the consumers are energized.

3. Since the vehicle hull is hermetically sealed, tightness of the engine fuel system is of particular importance. Even the slightest leakage of fuel through pipeline connections is impermissible. Before starting the engine after a halt, make sure there is no gasoline smell inside the vehicle.

It is strictly prohibited to use gasoline in wiping the vehicle assemblies or wash the electrical equipment with water while servicing the vehicle.

4. When using the starting preheater, rules outlined in Chapter 15 (Section "How to Use Starting Preheater") must be strictly followed to avoid the hazard of fire.

5. Take good care of brakes. Use of the parking brake instead of service brakes is harmful to the transmission and makes its service life shorter.

The hydraulic-brake system as well as clutch release control system should be filled with oil, type АМТ-10 only, in accordance with the Lubrication Chart and instructions outlined in Chapter 3 (Section "Clutch") and Chapter 4 (Section "Service Brakes"). Never mix oil of different grades.

6. When afloat or when coming out of water, it is prohibited to lower the splash panel and close the water jet shutter before the propeller screw is disengaged. Otherwise, water jet shutter shaft may be broken or the shutter itself may be warped.

7. With the first or reverse gear engaged, the gear-shifting lever should be fixed and the corresponding gear locked. Shifting of gears should be executed in full compliance with the requirements laid down in Chapter 16 (Section "Gear Shifting"). Incomplete engagement of gears may result in damage to the gearbox.

Do not exert too much effort on the control levers when shifting the levers of the gearbox, transfer case and power take-offs to the auxiliary wheels and water jet propeller. If these mechanisms are hard to be engaged, release the clutch pedal and let the shafts of the mechanisms rotate.

8. When moving under heavy-road conditions, engage the low-range gear. Be sure to engage it only after the vehicle is brought to a complete stop and the front axle is engaged.

9. Trenches and ditches should be negotiated with the vehicle moving at a right angle to the obstacle, at a minimum speed in the first gear with the front axle and the low-range gear engaged. The tyre pressure in this case must be 1.5 kgf/cm^2 in the main wheels and 5.5 to 6 kgf/cm^2 in the auxiliary wheels. The auxiliary wheels drive is engaged only after the wheels are lowered down to the working position. After the obstacle is negotiated, the drive must be disengaged.

10. Be sure to engage the winch only with the engine running idle at a low speed. In case the safety pin is sheared, stop the winch at once to prevent seizure of the winch intermediate propeller shaft yoke.

11. When negotiating water obstacles and when towing a similar vehicle afloat, adhere to the safety regulations set forth in Chapter 16 (Sections "Operation on Water" and "Towing the Vehicle").

12. In case the prolonged halt of the vehicle (more than one day) is expected, fill each fuel tank in amount less than its maximum capacity, at the rate of 1.5 ℓ per 10°C of temperature difference between the fuel to be filled and the ambient air. This is done to avoid fuel leakage through the filler neck plugs due to volumetric thermal expansion of fuel.

13. Be sure to remove vision devices from the vehicle before performing welding operations.

14. To ensure reliable operation of the engine, proceed as follows:

(a) in summer use A-76 summer grade gasoline (octane number according to the engine method), GOST 2084-77;

(b) in winter use A-76 winter grade gasoline, GOST 2084-77.

Operation of the vehicle in summer with violation of the above-mentioned rule as well as operation of the vehicle at elevated temperature in the engine compartment, with air inlet and air outlet doors closed, may result in formation of vapour locks in the supply system, in the engine interruption or stalling. In case of symptoms of the engine interruptions, open the air inlet and air outlet doors taking care not to stop the engine. If the engine has stopped, let it cool down, then start the engine again.

This warning note includes only the most important instructions. To operate the vehicle properly, the driver must study this Manual in full and strictly adhere to the instructions herein.

CAPACITY DATA

Fuel tanks (2 pcs), ℓ	280	Gasoline A-76, GOST 2084-77
Cooling system (in summer), ℓ	34	Water
Cooling system with heating unit (in winter), ℓ	35	Antifreeze In case water is used - 37ℓ
Engine lubricating system (including centrifugal oil cleaner, oil coolers and heat exchanger), ℓ	11	
Air cleaner, ℓ	0.55	Oil AC-8, GOST 10541-63
Oil tank (of engine), ℓ	7	
Gear case and power take-off case for water-jet propeller, ℓ	5	
Transfer case, ℓ	2	Oil MT-16n, GOST 6360-58. In areas with ambient temperature below -25°C use oil TCз-9гип or TC-10-OTП
Transfer reduction unit, ℓ	0.6	
Auxiliary wheels reduction gear case, ℓ	1.5	
Steering gear case, ℓ	0.67	Oil MT-16n
Winch reduction gear case, ℓ	0.65	
Water-jet propeller reduction gear case, ℓ	1.8	
Front axle housing, ℓ	6.8	Oil for truck hypoid gears. In areas with ambient temperature below -25°C use oil TCз-9гип
Rear axle housing, ℓ	9.8	
Hydraulic system, ℓ	8.5	Oil AMГ-10, GOST 6794-75
Shock absorbers (4 pcs), ℓ	2.04	
Hydraulic-brake system, ℓ	0.5	
Clutch release hydraulic control, ℓ	0.24	
Wheel hubs (4 pcs), kg	1.68	Lubricant ЦИАТИМ-201, GOST 6267-74
Auxiliary wheel bearings, kg	2.4	Grease (fat) 1-13, GOST 1631-61
Steering knuckles (2 pcs), kg	0.9	Mixture of grease УС, 70 per cent, and oil MT-16n, 30 per cent

MAIN ADJUSTMENT DATA (mm)

Clearance between rocker and valve on cold engine (both for intake and exhaust valves)	0.25-0.30
Breaker point gap	0.3-0.4
Spark-plug electrode gap	0.8-0.9
Clutch power cylinder piston travel	20-22
Free travel of service brake pedal	8-14
Clearance between push rod and piston in service brake hydraulic control master cylinder booster	1.5-2.5
Level of fluid in service brake and clutch release master cylinders (distance from the upper edge of plug hole to the fluid level)	15-20
Oil level in hydraulic system tank (distance from the upper edge of filling plug hole to the oil level with auxiliary wheels raised)	75-80

MAIN TECHNICAL DATA AND COMBAT CHARACTERISTICS

General

The БРДМ-2 armoured reconnaissance vehicle is an amphibious, two-axle, all-wheel drive, frameless wheeled vehicle with armoured hull used as the framework. It is equipped with tyre pressure control system and facilities for negotiating trenches and ditches. The engine is located in the rear of the vehicle.

Specifications

Type	Amphibious, wheeled
Hull	Welded of armour plates, watertight, covered with armour roof
Combat weight (mass), kg	7000+3 per cent
Combat weight distribution	50 per cent of total weight on each axle
Crew	4
Overall dimensions, mm:	
- hull length	5700
- length including water-jet propeller shutter	5750
- hull width	2262
- width of front axle	2350
Height of fully equipped vehicle (at tyre pressure of 2.8 kgf/cm^2), mm:	
- up to roof plate	1945
- including turret	2310
- including seat of vision device ТНПТ-1	2395
Wheel base , mm	3100
Front wheel tread , mm	1840
Rear wheel tread , mm	1790
Ground clearance (at tyre pressure of 2.8 kgf/cm^2),mm:	
- of rear axle housing	330
- of front axle housing	330
- of hull bottom	470
Maximum speed, km/h:	
- on highway	95-100
- on water (with water obstacle not less than 5 m deep)	8-10

Negotiable obstacles:	
- ascent (on solid ground)	30°
- side heel	25°
- trench w/o parapet (width), mm	1220
- parapeted trench (width), mm	1100
- parapet-to-parapet spacing, mm	1680
- height of parapet, mm	400
Angle of approach (hull)	43°
Angle of departure (hull)	35°
Radius of turn, m:	
- by track of outer front wheel	9
- by hull	10
Radius of circulation in water at a speed of 6-7 km/h, m:	
- to the left	10
- to the right	10
Fuel distance (highway), km, max	750
Endurance on water at a speed of 7 km/h, i.e. at engine cruising speed of approx. 2600 r/min, h, max	14-16

Engine

Type	Gasoline, carburettor, four-stroke
Cylinders	Eight, V-shaped arrangement
Cylinder bore, mm	100
Piston stroke, mm	88
Displacement, ℓ	5.53
Compression ratio (mean value)	6.7
Maximum power (with governor) at 3200 r/min, hp	140
Maximum torque at 2000-2500 r/min, kgf·m	36
Firing order	1-5-4-2-6-3-7-8
Cylinder block	Cast of aluminium alloy en bloc with crankcase upper half and fitted with wet-type quick-detachable cast-iron cylinder liners equipped with anticorrosion cast-iron inserts in their upper parts
Cylinder heads	Detachable, made of aluminium alloy, common for 4 cylinders of each row. Both heads are similar
Pistons	Made of aluminium alloy, tinned, flat-headed
Piston rings	Two compression rings and one oil control ring. Compression rings are made of cast-iron; the upper one is chrome-plated, the

	lower one is tinned. Oil control ring is of steel compound type
Piston pins	Full-floating, steel, hollow
Connecting rods	Forged, steel, I-beam, with bushing in small end
Crankshaft	Cast of high-test cast iron, four-throw, with dirt traps in crankpins
Crankshaft and crankpin rod bearings	Thin-walled aluminium steel-backed. All crankshaft shells are interchangeable, and so are connecting rod shells
Camshaft	Forged, steel, resting in five bearings fitted with threaded babbit-lined bushings
Valves	Arranged in row in cylinder head. Exhaust valves are sodium-cooled
Valve tappets	Plunger-type
Valve timing (with theoretical valve-to-rocker clearance of 0.35 mm)	Intake valves: - opening 24° before TDC; - closing 64° after BDC. Exhaust valves: - opening 50° before BDC - closing 22° after TDC
Intake and exhaust manifolds and fuel mixture heater	Intake manifold is cast of aluminium alloy and is provided with water heater for fuel mixture; exhaust manifolds (right and left) are cast of pig iron
Starting preheater	Gasoline, thermosiphon type, with blower and glow plug, mounted on LH side of the engine. Fuel is fed by gravity from the preheater fuel tank

Lubricating System

Type	Combined pressure-and-splash lubrication
Lubricating oil	AC-8, GOST 10541-63
Oil pump	Gear-type, two-section
Oil heat exchanger	Tubular, connected in tandem with oil coolers and cooled by outboard water when afloat. Made en bloc with water heat exchanger

Oil coolers	Three, tubular, mounted on LH water radiator of the cooling system
Crankcase ventilation	Open

Fuel System

Fuel	Gasoline, A-76*
Fuel tanks	Two, 140 l each
Fuel gravitation filter	Equipped with stack-type filter
Fine fuel filter	Gauze
Fuel pump	Diaphragm, with additional hand drive
Carburettor	Type K-126M, double-barrel, vertical, balanced, downdraft
Air cleaner	Inertia-oil type, contact-cleaning
Speed governor	Pneumocentrifugal type

Cooling System

Type	Liquid, sealed, with forced circulation
Water heat exchanger	Tubular, connected in tandem with water radiators. Made en bloc with oil heat exchanger
Water radiators	Two. Fin-and-tube, three-row type
Water pump	Centrifugal
Fans	Two. Six-blade, stamped. Driven by shaft with two semi-rigid couplings and two V-belts
Thermostat	Installed in branch pipe of intake manifold

Transmission

Clutch	Normally engaged, dry, single-disk, damper. Outer diameter of driven disk is 300 mm
Gearbox	Mechanical, four forward and one reverse speed gears
Gear ratio	1st gear - 6.55 2nd gear - 3.09 3rd gear - 1.7 4th gear - 1.0 Reverse gear - 7.77

*Use of A-72 gasoline is allowed for a short period only with the corresponding spark adjustment (decrease of timing angle).

Transfer en bloc with reduction unit and power take-offs to auxiliary wheels and winch	Suspended at four points on rubber pads. Has two ranges: high and low, the latter with ratio of 1.98. Constant gear ratio of transfer reduction unit is 0.97
Propeller shafts	Front and rear axle propeller shafts are tubular, open-type, fitted with sealed universal joints
Front and rear driving axles	Axle beams are stamped, welded, non-detachable
Steering geometry	Camber - $0^{\circ}45'$ Kingpin tilt - 9° Kingpin caster - 0° Toe-in - 2 to 5 mm
Axle drive	Hypoid, gear ratio - 6.83
Differential	High-friction, cam-type
Steering knuckles	Equipped with constant-velocity universal joints
Axle shafts	Fully unloaded
Translation of forces and reactive torque from front and rear axles	By leaf springs

Running Gear

Wheels	With detachable rim and inner spacing ring, 9.00x18"
Number of wheels	Front axle - 2 Rear axle - 2
Tyres	With controlled inflation Size: 13.00-18"
Tyre pressure	From 0.7 to 2.8 kgf/cm^2, controlled by driver
Wheel hub bearings	Roller, tapered
Leaf springs	Longitudinal, semielliptic. Spring ends are fitted into rubber pads
Shock absorbers	Hydraulic, telescopic, double-acting. Two shock absorbers for each axle

Brake Systems

Service brake system	Hydraulic, air-assisted (with pneumatic booster), double-shoe, sealed-type (front and rear wheels alike)
Parking brake system	Mechanical, shoe, drum-type, mounted on gearbox secondary shaft

Steering System

Type	Hourglass worm with tripple roller
Steering gear ratio	21.3 (average)
Steering wheel	Three-spoke, dia. 425 mm
Steering booster	Hydraulic
Steering drag link	Tubular
Steering tie rod	Bar
Vehicle steering on water	Steering rudders in water-jet branch pipe. Rudder control is linked with steering wheel
Reverse motion on water	By engaging reverse gear in power take-off to water-jet propeller

Tyre Pressure Control System

Air compressor	Piston-type, double-cylinder, single-stage compression
Compressor drive	V-belt, from engine crankshaft pulley
Rated working pressure	6 to 7.7 kgf/cm^2, maintained automatically by pressure regulator
Compressor output	220 ℓ/min at 2000 r/min of compressor crankshaft
Compressor lubrication	Pressure-type, linked to engine lubricating system
Compressor cooling	Liquid, forced, by engine cooling system
Air bottles	Two, with total capacity of 14.6 ℓ
Air bottle safety valve	Opens at a pressure of 9 to 9.5 kgf/cm^2
Tyre inflation system control	By means of air reducer and tyre pressure valves
Air delivery to wheels	Internal, with rubber seals
Air cocks	On front and rear wheels

Trench-Negotiating Equipment

Auxiliary wheels	Pneumatic, size 700x250 mm, working pressure 5.5-6 kgf/cm^2. Two rock-shaft-mounted wheels on each side
Power take-off	Pair of bevel gears, gear ratio 1.0. Mounted on transfer case
Propeller shafts	Left-hand: short, forged; right-hand: tubular, open-type; both are fitted with universal sealed joints

Auxiliary wheels drive chain	Bushing-roller type, pitch 25.4 mm
Auxiliary wheels hoist	Hydraulic, with ball lock
Number of hoists, pc	4
Diameter of hoist cylinder, mm	60
Rod travel, mm	276
Hydraulic system pump	Gear, LH type 623T1Л, mounted on power take-off to water-jet propeller, capacity 19.5 ℓ/min at 2500 r/min of pump shaft
Working pressure in hydraulic system, kgf/cm^2	120
Hydraulic system accessories	Slotted filter, safety valve, control valves and hydraulic locks

Water-Jet Propeller and Water Discharge Equipment

Water-jet propeller	Mounted in the hull rear, water intake from under vehicle bottom. Has two pairs of bevel gears, with each pair gear ratio of 1.15
Impeller	Four-blade, dia. 500 mm
Thrust at mooring (drawbar pull)	700 kgf at 900-1100 r/min of screw
Power take-off to water-jet propeller	Mounted on LH side of gearbox. Has 2 gears, one forward with a ratio of 2.41 and one reverse with a ratio of 1.7. Power take-off is controlled by driver's control lever
Water-jet propeller shaft	Tubular, open type
Water-jet shutter and splash panel	Hydraulically operated
Water discharge unit	Powered by water-jet propeller. Water discharge valve is located on right side of engine compartment. Capacity is 500 ℓ/min at maximum engine speed
Electric bilge pump	Installed on rear left side of engine compartment. Capacity is 100 ℓ/min, max
Hull drain valves	Two, installed in hull middle and nose parts

Electrical Equipment

Rated mains voltage, V	24
Wiring	Single wire with ground-returned minus

Generator	Type Г-290, operates together with generator regulator
Generator regulator	Type РР361А
Storage battery	Type 12СТ-70М
Battery switch	Type ВК-318Б
Ignition coil	Type Б102 shielded
Voltage divider	Type С3104-А
Ignition distributor	Type Р-105, shielded, with centrifugal and vacuum spark advance regulators
Spark plugs	Type А11 (20.8 mm wrench size)
Suppressor resistor	Type С314 on each spark plug
Starter	Type СТ-111
Starter closing switch	Type ВК-314
Headlights	Type ФГ-127 with blackout doors, 2 pcs Type ФГ-125 with light filters, 2 pcs
Rear lights	Type ФП-101-Г, 2 pcs
Spotlight	Type ОУ-3ГА-2, mounted on plate, of ТКН-1С
Lighting outfit	Inspection lamp, type ПЛТ 67-А, commander's lamp, type ПД 308А, lights, type ПТ37 (4 pcs)
Horn	Type С-314Г, electrical, vibrating, sealed
Light switch	Type П312
Blackout mode switch	Type П-29В
Protective devices	Thermal, bimetal Three 20 A, type ПР2Б; three 15 A, type ПР315; two 10 A, type ПР310
Circuit breakers	Type АЗС-5 - 1 pc; АЗС-15 - 2 pcs; АЗС-30 - 1 pc; АЗС-50 - 1 pc; АЗС-2 - 2 pcs
Stop light switch	Type ВК-12Б
Side lamps and turn indicators	Type ПФ-101В, 2 pcs
Air inlet and outlet door control switch	Type ПН45М-2
Turn indicators switch	Type П-118
Turn indicator breaker	Type РС-401Б
Radiator temperature warning light sending unit	Type ТМ-104Т
Windshield wiper	Type СЛ-224, mechanical, driven by electric motor (may be driven by hand)
Heater and defroster switches	Type П119Б, 2 pcs
Switch of electric fan and electromagnetic valve of heater	Type П305
Heater spark plug	Type СР65А
Heater spark plug switch	Type В45М

Windshield defroster motor	*Type M3205*
Heater motor	Type M3247
Air inlet and outlet door control motor	Type M3212-Г
Preheater motor	Type M3202-Б
Bilge pump motor	Type МВП-2
Resistor	Type С3329
Bulbs for control (pilot) lamps of instrument panel and turret mount control board, pc	Three (24 V x 1 cd)
Bulbs for dial lamps of instrument panel and turret mount control board, pc	Twelve (24 V x 1 cd)
Bulbs for head lamps, pc	Four (24 V 40 W)
Bulbs for tail-and-stop lamps, pc	Four (two 24 V x 21 cd and two 24 V x 3 cd)
Bulbs for side lamps, pc	Two (24 V x 32+4 cd)
Bulbs for commander's lamp and air cock light, pc	Two (24 V x 3 cd)
Bulbs for dome lights and inspection lamp,pc	Five (28 V 10 W)

Instruments

Speedometer	Type СП24-Г, with flexible shaft drive
Voltammeter	Type ВА-340Т, for measuring voltage and current intensity in battery charging circuit
Fuel gauge	Type УБ-102БТ, with two gasoline depth rheostats, type БМ-116-А in fuel tanks
Fuel gauge sending unit change-over switch ...	Type ПП-45М
Oil pressure gauge	Type УК-140Т, with pickup, type ММ-358Т
Water and oil temperature gauges	Type УК-114БТ, with pickup, type ТМ-100
Tyre pressure gauge	Low-pressure, type МД-101
Air bottles pressure gauge	МА-10
Radiator water overheating pilot lamp	Type ПД20-К
Turn indicators pilot lamp	Type ПД20-Л

Special Equipment

External communication	Radio set (located in driving compartment) with SPTA and spare antenna
Intravehicle communication	Oral
Roentgenometer, type ДП-3Б	Installed in RH front wheel bay. Remote unit fastened on vehicle hull front lower plate
Field chemical agent detector kit (ВПХР)	Fastened on RH side of hull superstructure (upper portion)
Special decontamination kit, type ДК-4Б	Fastened in bat at LH front auxiliary wheel
Navigational equipment	Located in driving compartment

Winch	Installed under deck in hull nose. Gear ratio 23. Traction power on the rope hook is 4400-6000 kgf with a single-row rope winding on drum. The rope length is 30 m
Winch drive	Through two propeller shafts with intermediate bearing by transfer case reduction unit
Filter-ventilator unit (ФВУ)	Installed in engine compartment on LH side near engine compartment bulkhead. Powered by 27-V electric motor, type МВ-67. Capacity when blowing air through bypass line is 5 to 6 m^3/min and when blowing through absorption filter ФПТ-100М is 1.3 to 1.6 m^3/min. When blowing through filter ФПТ-100М, overpressure built in fighting compartment is not less than 30-35 mm H_2O
Heater	Hot-air type, installed in hull nose
Windshield defrosting	By hot air fed by electric blower from heater
Driver's tools	Tool kit in two bags stowed inside vehicle
Entrenching tools	Shovel, crowbar and single-handle saw are stowed outside, and axe is stowed inside vehicle
Rigging equipment	Boat hook and towing rope secured on deck
Fire extinguisher	Type ОУ-2, carbon-dioxide, secured on engine compartment bulkhead
First aid kit	Secured on engine compartment bulkhead
Towing equipment	Towing hooks are welded to vehicle front and rear framework plates. One staple for towing vehicle afloat is located in hull nose and two staples are located in hull back
Life jackets	Type СЖТ-58, one for each crew member, stowed on cover of tool box

Armament

Type of mount	Turret, machine-gun
Machine guns, coaxial:	
(a) 14.5 mm КПВТ	One
(b) 7.62 mm ПКТ	One

Field of fire:	
traversing range	360°
elevation range	from -5° to +30°
Sight:	Type ПП-61АМ
periscope height, mm	285
field of view	23°
magnification	2.6
Sight heated protective glass	Type С312
Laying mechanisms:	
traversing	Manual
elevating	Manual
Rates of laying (per one revolution of handwheel):	
rate of traverse	21°
rate of elevation	4°
Turning force (with mount in horizontal), kgf:	
for traversing handwheel	up to 5
for elevation handwheel	up to 4
Unit of fire:	
machine gun, type КПВТ, rds	500
machine gun, type ПКТ, rds	2000
Ammunition chest capacity:	
machine gun, type КПВТ, rds	50
machine gun, type ПКТ, rds	250
Capacity of fired case (belt) deflector bag:	
ПКТ machine-gun cases, pc	250
ПКТ machine-gun belts, pc	Ten (25 links each)
КПВТ machine-gun belts, pc	Five (10 links each)
Weight of turret machine-gun mount with machine guns and sight, kgf	405
Turret outer diameter, mm	1424
Turret race bore, mm	1075
Maximum turning radius of turret mount, mm	1050
Maximum turning radius of КПВТ machine-gun barrel, mm	1590
Height of turret mount from turret race base, mm	365
Height of turret mount from turret race ТНПТ-1 device seat, mm	447
Height to bore of machine gun from turret race base, mm	165
Height to bore of machine gun from ground, mm	2110
Submachine gun, type АКМ, pc	One, on LH side of vehicle
Hand grenades, pc	Nine, near bay of LH second auxiliary wheel
Flare gun, pc	One, in RH front bay

Vision Equipment

Commander's daylight vision devices	ТПКУ-2Б (1 pc), ТНПО-115 (1 pc); ТНП-Б (3 pcs)

Driver's daylight vision devices	ТНПО-115 (2 pcs), ТНП-Б (4 pcs)
Daylight vision devices for crew	ТНП-Б (6 pcs)
Gunner's daylight vision device	ТНПТ-1 (1 pc). Installed in turret roof
Commander's night vision device	ТКН-1С (1 pc)
Spotlight	ОУ-3ГА-2. Installed on ТКН-1С device board
Driver's night vision device	ТВНО-2Б (1 pc)
Ports for observation and hand arms firing	Two, made in vehicle hull superstructure (one on each side)

Part I

BRIEF DESCRIPTION OF VEHICLE WITH MAJOR INSTRUCTIONS ON CARE AND SERVICE ADJUSTMENTS

Chapter 1

ARMOURED HULL

The hull of the vehicle is watertight, boat-like, welded of armour plates and covered with an armour roof. The hull is integral with the framework, i.e. serves as a base for mounting all other parts and assemblies of the vehicle. The hull has three compartments: driving compartment, fighting compartment and engine compartment. The fighting compartment is separated from the engine compartment by a watertight bulkhead.

The driving compartment is in the front (bow) part of the hull and accommodates the vehicle controls, instruments, vision equipment, radio set and driver's and commander's seats.

The seats may be adjusted lengthwise and in height (by locking each seat in three positions). Besides, seat back tilting may be also adjusted.

The front upper plate of the hull if provided with two lookout hatches (one in front of the commander and one in front of the driver) closed with armour visors that can be raised and locked open. Glass in hatches is rubber-framed.

The front top part of the hull mounts seven vision devices, type ТНП-5, and three devices, type ТНПО-115, for daylight combat surveillance. Besides, the vehicle commander makes use of the ТПКУ-2Б daylight vision device.

For night-time observation, the commander's vision device ТПКУ-2Б is replaced by vision device ТКН-1С with infrared searchlight ОУ-3ГА-2, and one of driver's ТНПО-115 devices is replaced with device ТВНО-2Б.

Roentgenometer ДП-3Б is brackted in the bay of the right front wheel. The roentgenometer remote unit is mounted on the lower front plate of the vehicle hull.

The fighting compartment is in the middle of the hull. The bulkhead located in the rear part of the fighting compartment has hatches for access to the engine compartment from the inside of the vehicle.

The fighting compartment accommodates a turret on the race installed on the superstructure roof, two one-man seats for the crew and the gunner's hammock-type seat which can be adjusted in height. Arranged on the floor of the fighting compartment (in the middle) is the transfer case made en bloc with the reduction unit and power take-off to auxiliary wheels. This assembly is covered with a sealed casing.

For getting into the driving and the fighting compartments, two entrance hatches are provided in the hull roof. The hatch door can be locked from the inside and from the outside. To close the hatch doors from the outside, their lock handles should be previously set in the closed position.

Two oval-shaped portholes (one on each side) are made in the hull superstructure sloping plates for observation and hand arms firing. The portholes are fitted with armour caps to be opened from the inside.

In addition to the portholes, used for observation are the ТНП-Б devices installed in the side sloping plates of the hull superstructure (three devices on each side).

The fighting compartment houses also auxiliary wheels hydraulic hoists, SPTA boxes, driver's tools and other vehicle equipment (fire extinguisher, first aid kit, etc.).

The floor has a recess for stowing the tools; it is provided with a hinged cover plate.

The engine compartment is located in the rear (stern) of the hull. It houses the engine, generator, water radiator, oil cooler, water and oil heat exchangers, compressor, starting preheater, gearbox with a power take-off to the water-jet propeller and hydraulic pump, electric bilge pump, water drain valve whose remote control handle is located in the fighting compartment, cardan drive for water-jet propeller, storage battery, air bottles (receivers), filter-ventilator unit, starting preheater fuel tank and engine manual cranking handle. The exhaust mufflers are installed on the outside of the vehicle on the hull sloping plates.

The engine compartment has air inlet and outlet ports covered by doors.

Air inlet doors 1 and 2 (Fig. 1) are mounted on the detachable four-section roof plate and on cap 3 of the two-section upper access hatch of the engine compartment. Four air outlet doors 5 are located on the rear hinged plate of the roof.

Air inlet and outlet doors are opened and closed with the help of electrically actuated control 4, fastened to brackets welded to the bay of rear LH wheel. The control is handled by the driver using a special switch.

The doors are adjusted for complete opening and closing in the course of installation by changing the length of rods 8, 9, 10, 11, 12 and 13. If driving care is proper, no additional adjustment of the doors control is required.

WARNING: To avoid breakage of elements of the air inlet and outlet doors control system, never tread on them or load them with foreign objects.

Engine compartment upper access hatch cap 3 is mounted on two inner hinges 6 and is fastened by two locks located on the rear flange of the access hatch. This cap may be flapped open only after the air inlet doors are fully opened.

Cap 3 becomes fixed in the opened position by two stops 7 located on hinges 6. To close the cap, it must be first released from the stops to avoid warping of the hinges.

In the rear of the vehicle, two fuel tanks are arranged in the sections isolated from the engine compartment (one tank is on the left side and the other on the right side of the hull).

The rear hull plate has small hatches providing access to the fuel tank filler necks covered by armour caps.

Access to the fuel tanks is ensured through the right side hatches covered by hinged armour caps. The latter are secured by flat-head screws so that not to interfere with water-jet shutter operation.

For towing the vehicle on land, two towing hooks are located in the lower front part of the hull and two more in the lower rear part of it.

For towing the vehicle on water, the front part of the hull is equipped with one staple and the rear one, with two. These staples, however, must never be used for towing the vehicle on land.

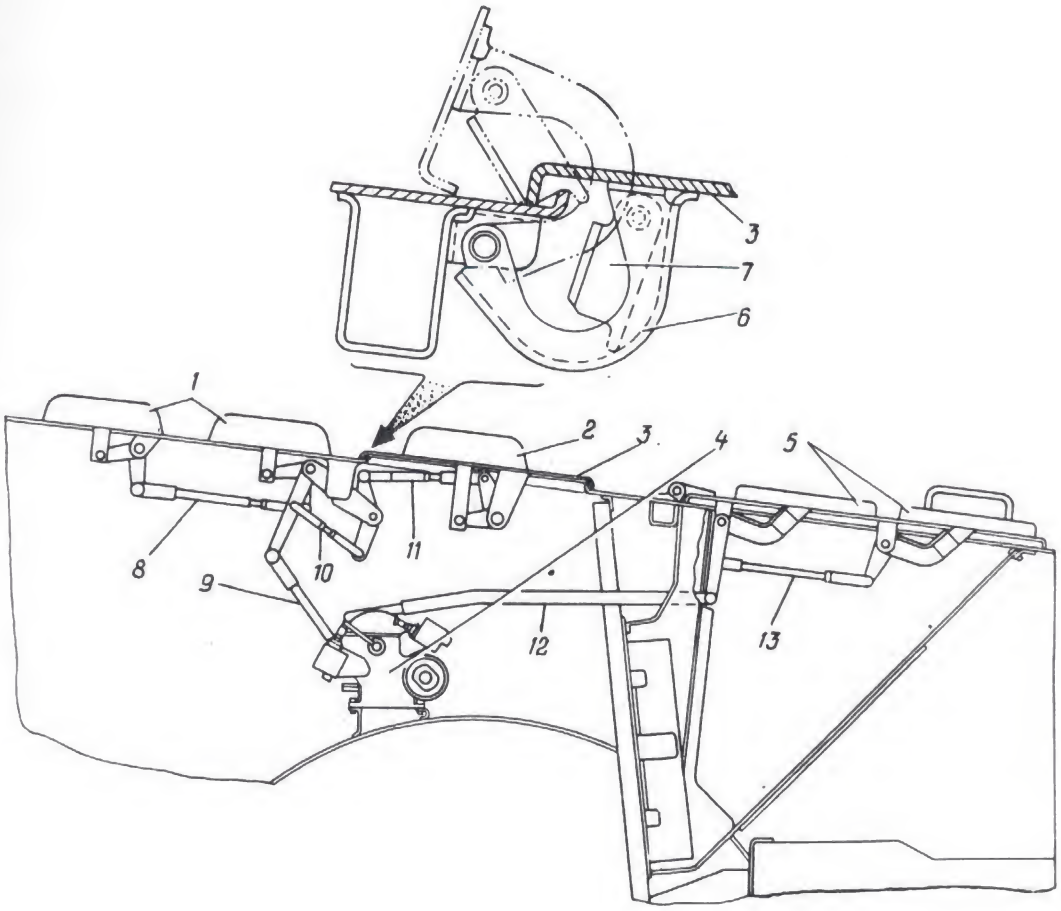

FIG. 1. AIR INLET AND OUTLET DOORS

1 and 2 – air inlet doors; 3 – engine access hatch cap; 4 – electric control; 5 – air outlet doors; 6 – hinge; 7 – stop; 8, 9, 10, 11, 12 and 13 – rods

Chapter 2

POWER PLANT

The vehicle power plant consists of the engine and its systems: lubricating system, cooling system, fuel system, ignition system and starting system*.

ENGINE

The vehicle is equipped with a four-stroke, V-shaped, eight-cylinder, carburettor gasolene engine.

The engine complete with the clutch, gearbox, power take-off to water-jet propeller and hydraulic pump makes up a single assembly installed in the rear of the hull on four rubber pads.

The cylinder block is fitted with wet liners which are pressed to the block by the cylinder heads.

Adequate sealing in the upper part is achieved by the use of cylinder head asbestos-steel gaskets, while in the lower part sealing is ensured by copper ring gaskets placed between the cylinder block and the liner.

Cylinder numbering order is shown in Fig. 2.

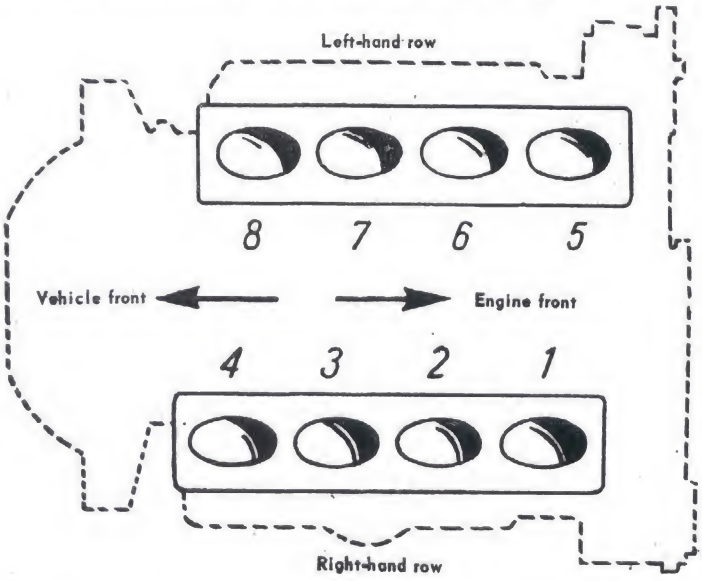

FIG. 2. CYLINDER NUMBERING ORDER

* In the present Manual, Section "Ignition System" is included in Chapter 9, and the starting preheater is dealt with in Chapter 15.

The cylinder heads are fitted with inserted valve seats and valve guides.

Each cylinder head is attached to the cylinder block by means of eighteen studs. Tighten the stud nuts with the special torque-indicating wrench. Its application makes controllable the torque that must range from 7.3 to 7.8 kgf·m. The stud nuts may be also tightened with the special cylinder head nut wrench (17x19) available in the vehicle SPTA set. The nuts must be driven smoothly and only by one hand. The nuts should be tightened on cold engine in two or three stages following the order shown in Fig. 3. Before tightening the stud nuts, drain coolant from the cooling system and loosen the intake manifold nuts.

Prior to removing the rocker RH cover, proceed as follows:

(a) loosen the compressor fastening by turning back its three nuts by 5 to 7 mm;
(b) remove the adjusting plate bolt;
(c) remove the compressor drive belt;
(d) shift the compressor forward.

To enable access to the cylinder head nuts, unscrew the rocker shaft support nuts, lift or remove the shaft jointly with the rockers, and remove the shield of

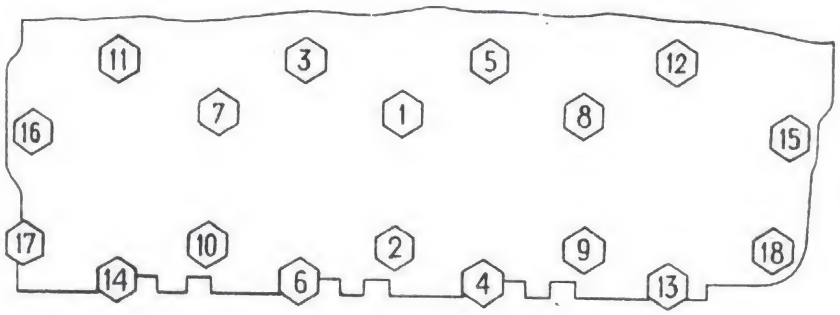

FIG. 3. CYLINDER HEAD NUTS TIGHTENING ORDER

the spark plugs. It is advisable to take the valve rods out of their seats to avoid accidental bending. After tightening up the cylinder head nuts, reinstall and secure all the removed parts. This done, adjust the clearances between the valves and the rockers. The first tightening of the cylinder head nuts on a new vehicle must be done after 1000 km of run, the second after 3000 km, and all the successive ones in the course of every other Preventive Maintenance No. 2, i.e. every 6000 km of run.

Tightening of intake manifold nuts as well as its reinstallment must be done as carefully as possible, to prevent coolant from getting into lubricant.

Prior to installation, check condition of mating surfaces of the intake manifold, cylinder head and cylinder block, and that of the gaskets. At first, screw the nuts so as to press the gaskets only slightly, and then tighten them securely in two or three stages starting from the middle of the intake manifold alternately on the LH and RH cylinder heads by applying moderate hand effort. Keep in mind that the rubber gasket makes one feel that the nuts are not completely tightened. Hence, tighten the nuts so that the gasket is compressed by 1 to 1.5 mm.

Valve Timing Mechanism

The camshaft is driven by two gears: a steel one fitted on the crankshaft and a textolite one fitted on the camshaft.

The valves are actuated by the camshaft through tappets 2 (Fig. 4), push rods 4 and rockers 8. Spring 14 of valve 5 thrusts against valve spring collar 13 connected with the valve through retainers 12. When the engine is running, the valve revolves thus decreasing wear of the valve stem and spring collar 13.

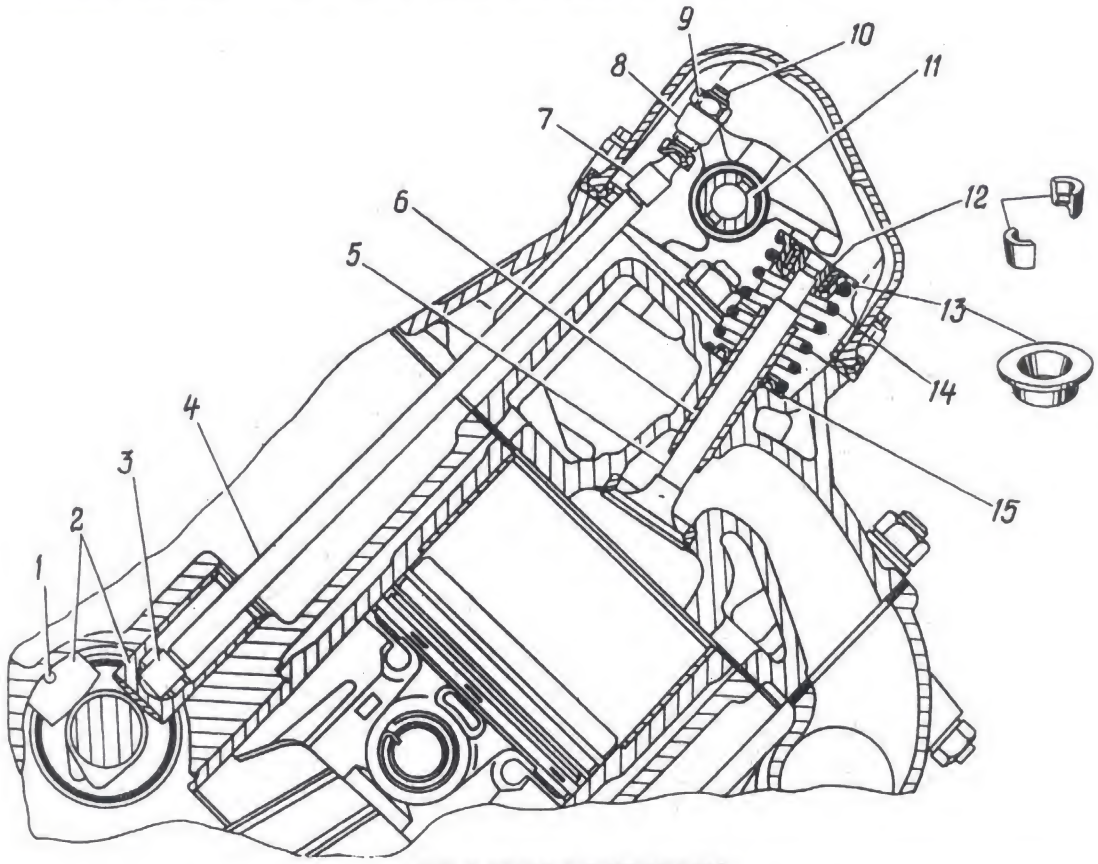

FIG. 4. VALVE ACTUATING GEAR

1 – oil outlet opening; 2 – valve tappet; 3 and 7 – push rod tips; 4 – push rod; 5 – valve; 6 – valve guide; 8 – rocker; 9 – lock nut; 10 – adjusting screw; 11 – rocker axle; 12 – retainers; 13 – thrust bushing; 14 – spring; 15 – thrust washer

The clearance between the valve rocker and the valve on a cold engine (at a temperature of 15 to 20°C) should be 0.25 to 0.30 mm for both the inlet and exhaust valves. Due to non-uniform heating of different parts of the hot running engine the above-mentioned clearance may vary. Therefore, under certain conditions of the engine operation one can hear valve knocking which may appear and disappear at times. Such hardly audible intermittent pinging is not dangerous and does not call for decreasing the clearance between the valve and the rocker. However, if in a hot engine the valve knocking is continuous, the valve-to-rocker clearance must be adjusted.

To remove the rocker RH cover, shift the compressor forward (as in tightening of the cylinder head nuts) and remove two union nuts of the RH screening hose from the distributor and spark plug shield.

Prior to adjusting the clearance in the valves of the first cylinder, bring piston to TDC in compression stroke (see Section "Spare Timing" in Chapter 9. "Electrical Equipment"). To adjust the clearance, slacken the lock nut on adjusting screw 10 and rotate the adjusting screw with a screwdriver to obtain the required clearance with the use of the feeler gauge. Then tighten up the lock nut and check the clearance again. The clearances in the valves of the other cylinders should be adjusted in the sequence corresponding to the firing order (1, 5, 4, 2, 6, 3, 7, 8). Passing from cylinder to cylinder, turn the crankshaft through 90°.

Lubricating System

The engine lubricating system is combined-type. Pressure-lubricated are crankshaft and crankpin bearings, camshaft bearings and thrust flange, rocker shafts, and upper tips of push rods.

Splash-lubricated are cylinder faces, connecting rod small end bushes, piston rings, valves, tappets and camshaft cams.

Camshaft drive gears are lubricated by oil coming down from the centrifugal oil cleaner, and the ignition distributor drive and its gears are lubricated by oil seeping from the cavity located between the fifth camshaft journal and the stopper in the cylinder block.

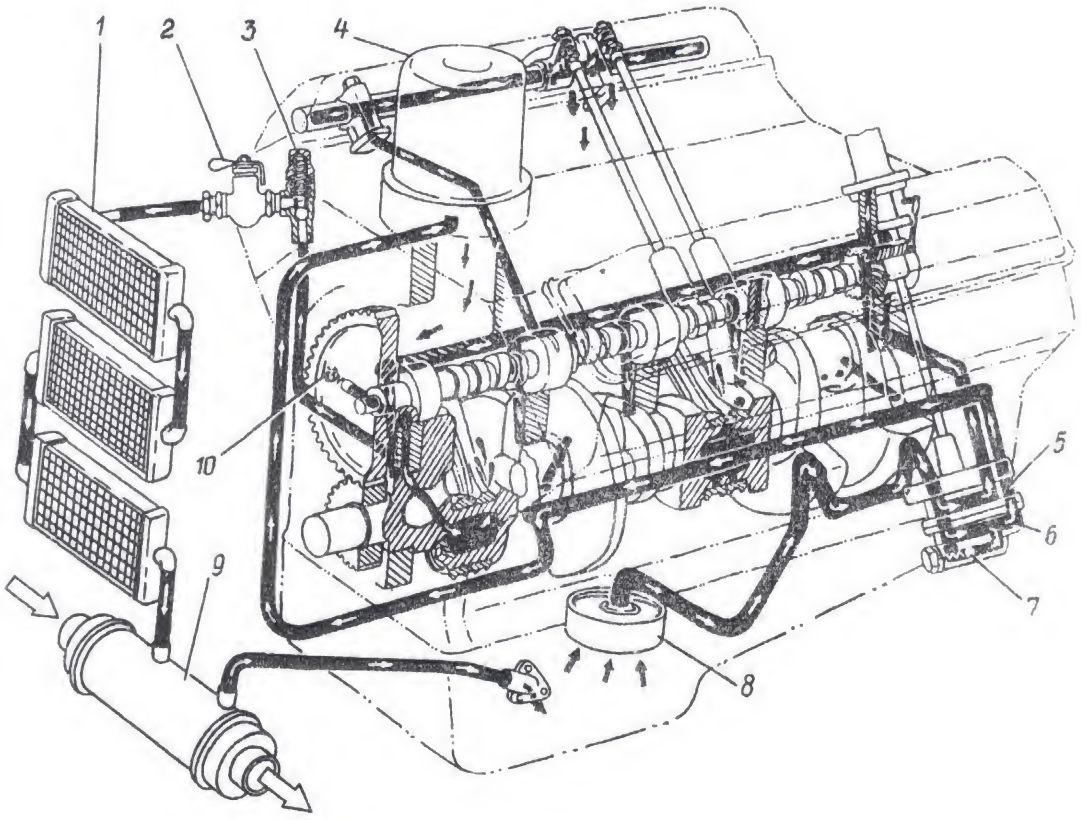

FIG. 5. ENGINE LUBRICATING SYSTEM

1 – oil cooler; 2 – oil cooler cock; 3 – safety valve; 4 – centrifugal oil cleaner; 5 – oil pump main section; 6 – oil pump auxiliary section; 7, 10 – reducing valves; 8 – oil header; 9 – heat exchanger

Oil is delivered to oil coolers 1 (Fig. 5) through safety valve 3. This valve gets open at a pressure of approximately 1 kgf/cm^2 and, consequently, oil circulates in the coolers only at a pressure higher than 1 kgf/cm^2. Passing through the coolers and heat exchanger 9, the oil comes to the engine crankcase.

All the engine lubricating system valves are adjusted at the Manufacturing plant and their re-adjustment in service is strictly prohibited.

Oil circulating in engines equipped with centrifugal cleaners is darker as compared to that in engines equipped with fine oil filters. Change in the colour of oil does not necessitate its renewal.

During inspections it is necessary to check the oil level in the lubricating system. It should be always kept at the "П" mark on the dipstick.

As a result of a prolonged standstill of the vehicle the level of oil may be somewhat higher than the "П" mark due to overflow of oil from the filter and coolers into the engine crankcase. To find the oil level more accurately, run the engine for several minutes and check the oil level 3 to 5 min after the engine shutdown. If the oil level in the crankcase is below the "П" mark on the dipstick, top up the lubricating system.

Each time when adjusting the valve-to-rocker clearance and during each seasonal maintenance, make sure that oil gets to the rocker shafts. For this purpose, start the engine to see that oil runs out of the hole in each of the adjusting screws and trickles down the rods. If not, clean oil channels in cylinder heads with wire and blow it through with compressed air. For this purpose, remove the rocker shaft and drive out the stud of the rocker shaft support where oil is supplied. If unscheduled disassembly of the engine takes place, use the opportunity to clean the oil channels in the cylinder block from gum residue after removing the cylinder heads.

Regardless of ambient air temperature, engage the oil coolers when operating the vehicle under extremely heavy road conditions. With the oil coolers engaged, the handle of the oil cooler cock should be set along the cock body.

The oil pump (Fig. 6) is a gear-type one.

Pump upper section driving gear 12 pressed on shaft 11 is held against axial displacement by a pin. Lower section driving gear 13 is keyed.

Driven gears 2 and 5 rotate on axles pressed in cases 1 and 6 of the pump sections.

A hexagon hole in the upper end of driving shaft 11 receives the distributor drive shaft end.

Placed between the two sections of the pump is partition plate 3 sealed on both sides by gaskets 4.

After disassembly of the pump or when replacing the latter, fill it with oil prior to mounting the pump on the engine, otherwise it will not suck oil from the engine crankcase.

The reducing valve of the pump upper section is positioned on the cylinder block on the right side of the engine (which is the left side of the vehicle) below the fuel pump, and the lower section reducing valve is positioned right in the pump body. Both reducing valves are identical. The main components of the valve are plunger 10 (see Fig. 6), spring 9, gasket 8 and plug 7. The reducing valves are used to prevent excessive oil pressure in the oil system (oil pressure should not exceed 5.5 kgf/cm^2 at a temperature of oil ranging from 80 to 90°C).

A sudden drop in oil pressure may occur as a result of clogging in the reducing valve. If so, disassemble the valve and wash it in kerosene. Do not disturb the valve adjustment (that is, do not change the thickness of the gasket and do not stretch or heat the spring).

The oil pump and ignition distributor drive consists of body 1 (Fig. 7) in which ignition distributor drive shaft 2 rotates. The lower part of shaft 2 is connected through safety pin 5 with driven gear 3 and oil pump drive hexahedral shaft 7. The driving gear is made integral with the camshaft. Pin 5 is made of steel 20. Its length is 22 mm and dia. 3.5 mm. The pin is prevented from dropping out by spring ring 4. Shaft 7 is received by a hexagonal hole in the upper end of the oil pump drive shaft.

In case of seizing or jamming in the oil pump, pin 5 becomes sheared off and gear 3 slips on shaft 2. This leads to ignition cut-off and shutting down of the engine. The indication of the pin shearing is non-uniform rotation of the distributor rotor or none at all when the crankshaft revolves.

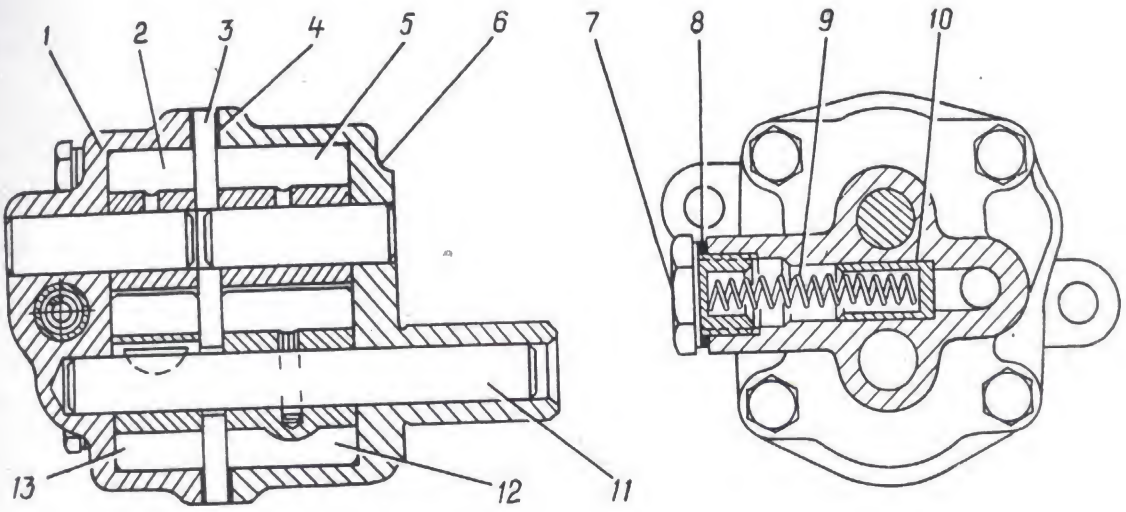

FIG. 6. OIL PUMP

1 – lower section case; 2 – lower section driven gear; 3 – partition plate; 4 – gasket; 5 – driven gear; 6 – upper section case 7 – plug; 8 – gasket; 9 – spring; 10 – plunger; 11 – drive shaft; 12 – upper section driving gear; 13 – lower section driving gear

In case of engine stalling, find and eliminate the cause of the oil pump seizing or jamming. Most frequently the cause of that in winter is water in the lubricating system and its freezing in the oil pump.

To recondition the oil pump and ignition distributor drive, proceed as follows:

1. Remove the drive from the engine.
2. Remove spring ring 4.
3. Remove remains of sheared-off pin 5.
4. Install a new safety pin available in the vehicle SPTA set.
5. Reinstall spring ring 4.
6. Reinstall the drive on the engine.
7. Adjust ignition timing.

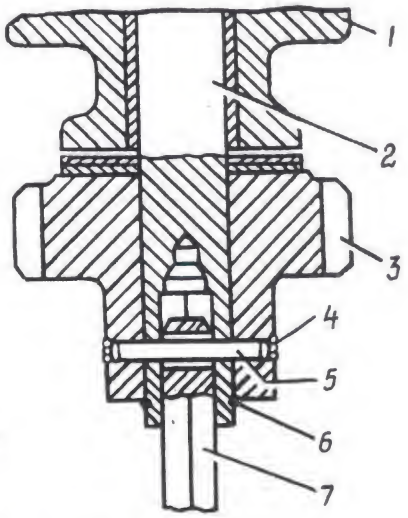

FIG. 7. OIL PUMP AND IGNITION DISTRIBUTOR DRIVE

1 – drive body; 2 – ignition distributor drive shaft; 3 – driven gear; 4 – spring ring; 5 – safety pin; 6 – lock ring; 7 – oil pump drive shaft

The oil header is provided with a gauze filter which should be cleaned periodically (when the engine is disassembled). To remove the oil header, screw off the fastening nut. To remove the gauze, it is sufficient to disconnect the frame spring. To prevent air inleakage, see that the rubber packing ring of the oil header pipe is properly installed.

The centrifugal oil cleaner. Oil is pressure-fed through hollow axle 1 (Fig. 8) and fills the space in rotor housing 8. Oil then goes through gauze 10 and is ejected from nozzles 3. After that it flows down to the engine crankcase. Oil jets make rotor 7 rotate.

As the rotor rotates, heavy contamination particles are thrown against the inner wall of housing 8 and settle there in the form of thick deposit. Besides, oil is filtered by gauze 10.

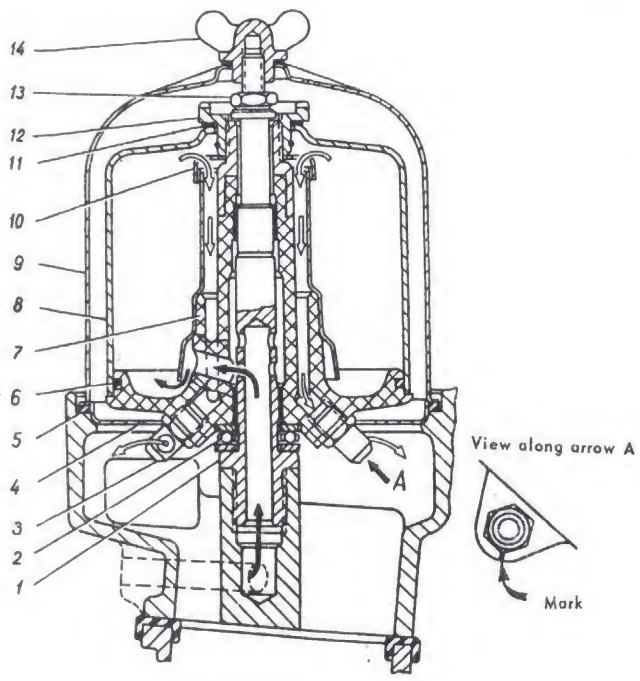

FIG. 8. CENTRIFUGAL OIL CLEANER

1 – rotor axle; 2 – thrust bearing; 3 – nozzle; 4 – repeller; 5 – gasket; 6 – packing; 7 – rotor; 8 – rotor housing; 9 – oil cleaner casing; 10 – filter gauze; 11 – gasket; 12 – rotor housing nut; 13 – rotor attachment nut; 14 – oil cleaner casing wing nut

Care of Lubricating System

While performing operations pertaining to some kinds of maintenance, do the following.

1. During the Routine Inspection, Daily Maintenance and Preventive Maintenance No. 1:

(a) check the lubricating system for filling. Refill it, if necessary;

(b) check the system for oil leakage. In case of leakage, correct the fault.

2. During Preventive Maintenance No. 2:

- change oil in the crankcase;
- clean and wash the centrifugal oil cleaner. For this purpose remove the crankcase ventilation filter from the oil filling branch pipe carefully and proceed as follows:

(a) unscrew wing nut 14 (see Fig. 8) and remove cleaner casing 9 from the oil cleaner;

(b) unscrew nut 12 with a special wrench and carefully pull up the nut to remove the casing while holding rotor housing 8 against revolution;

(c) remove gauze 10. Clean the rotor housing of deposit and wash the housing and gauze in kerosene;

(d) carefully reinstall the gauze and rotor housing; see that rubber packing 6 is not being damaged. Then screw on rotor housing nut 12 fingertight; in doing this, see that rotor housing 8 is not skewed when mounted;

(e) reinstall oil cleaner casing 9 and screw up wing nut 14;

(f) reinstall the crankcase ventilation filter, start the engine and check for leakage of oil through the oil cleaner joints.

3. Clean the cleaner of deposit and dirt after 15,000 km of run. When stripping the cleaner, screw off nut 13, remove rotor 7 from its axle, wash the rotor in kerosene, blow it through with compressed air via the nozzle orifices, and carefully reinstall it.

CAUTION: Since the effectiveness of oil cleaning largely depends on the rotor speed, the air cleaner should be disassembled with great care. Dropping, impacts and dents on the rotor housing and bending of the cleaner axle result in unbalance of rotating parts. So when screwing off the rotor housing nut never try to hold the housing against revolution by wedging it with a screwdriver or any other tool.
In removing the rotor, the upper ring of thrust bearing 2 may stick to the rotor. Be careful and hold the ring from below by hand to prevent it from being dropped and lost.

Crankcase Ventilation

The crankcase ventilation system is of an open, exhaust type. Exhaust gases and vapour are sucked out through the exhaust pipe. Fresh air comes through a branch pipe which is also used for filling the engine with oil. To prevent penetration of

dust into the engine, the branch pipe is fitted with a sealed expendable filter. The filter filling is capron fibre.

When oil is renewed in the engine, wash the filter filling in kerosene, then let kerosene run off and soak the filling in oil AC-8. Mind that a dry filter filling lets dust into the engine.

Cooling System

The engine cooling system is a liquid-type one.

The coolant flow path is as follows.

Heated coolant goes out of the engine through outlet branch pipe 1 (Fig. 9) to the upper tanks of two radiators 4. Streaming down the pipes from the upper tank into the lower one, coolant is cooled. Now cool,coolant goes from the lower tanks of the radiators to heat exchanger 5 from which it is forced into the cylinder block by centrifugal pump 2.

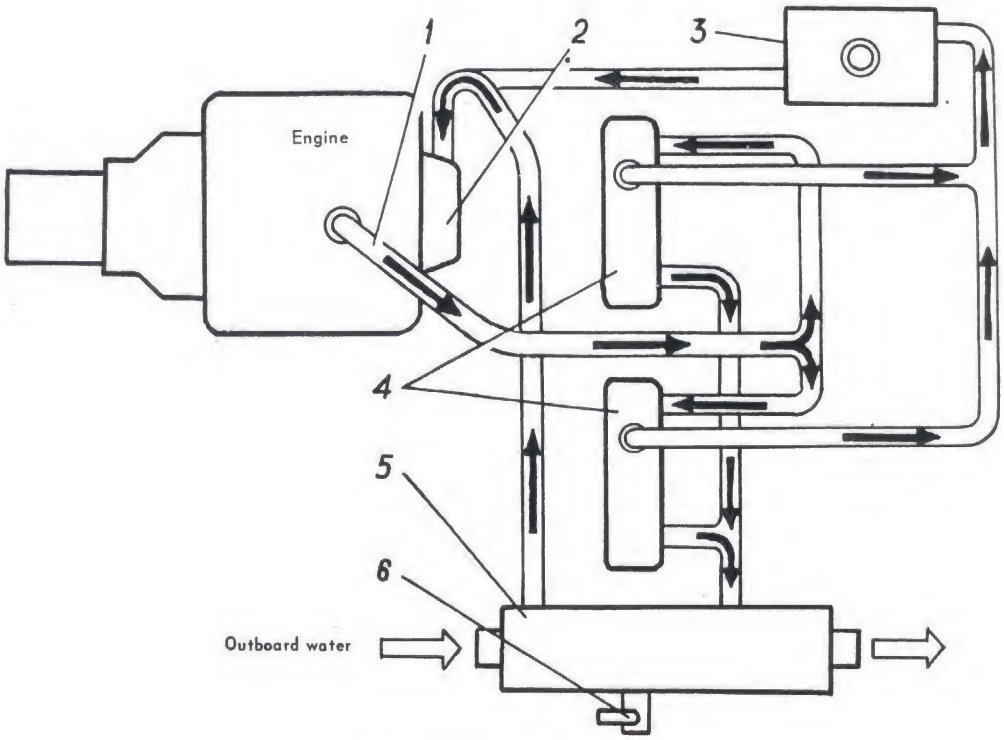

FIG. 9. COOLING SYSTEM LAYOUT

1 – outlet branch pipe; 2 – water pump; 3 – expansion tank; 4 – radiators; 5 – heat exchanger; 6 – drain cock

Included in the cooling system are also the jackets of the starting preheater boiler and the cylinder block and compressor head cooling jackets. Bear in mind that the compressor cooling system is filled with coolant only when the engine is running. Therefore, after filling the expansion tank with coolant, start the engine and let it run for 3 to 5 min, then check the level of coolant in the expansion tank and top it up, if necessary.

To maintain optimum thermal conditions for the running engine (80°to 90°C) and to accelerate warming-up, a thermostat is provided in the cooling system.

The water radiators. Below the radiators are fastened to the brackets welded on the hull. Radiators rest on rubber pads. Atop the radiators are secured by braces.

Radiators are cooled by air coming into the engine compartment through the air inlet port and going out through the air outlet port. The engine thermal conditions are regulated by the driver who operates the electrically-controlled air inlet and outlet doors.

The expansion tank. For better functioning of the water pump and the cooling system as a whole, the vehicle is equipped with expansion tank 3 (Fig. 9). Air penetrating in the cooling system and vapour formed inside it accumulate in the upper tanks of the radiators and are discharged through hoses into the expansion tank.

Fill the cooling system with water up to the level of 1/2 to 2/3 of the expansion tank volume through the filler hole closed by a cap. When filling the system with antifreeze, pour the latter until its depth in the expansion tank is 1-2 cm.

To maintain pressure in the cooling system within the optimum range, the filler cap of the expansion tank is fitted with inlet and outlet valves.

The inlet valve is used for admission of air into the cooling system when rarefaction in the latter is as high as 0.01 - 0.1 kgf/cm^2. If pressure becomes as high as 0.45 - 0.55 kgf/cm^2, the outlet valve gets open and lets excessive vapour out of the cooling system.

The water pump is centrifugal. The pump is sealed by a spring-loaded oil seal. Oil seal rubber cup 11 (Fig. 10) and black lead washer 12 rotate along with shaft 3.

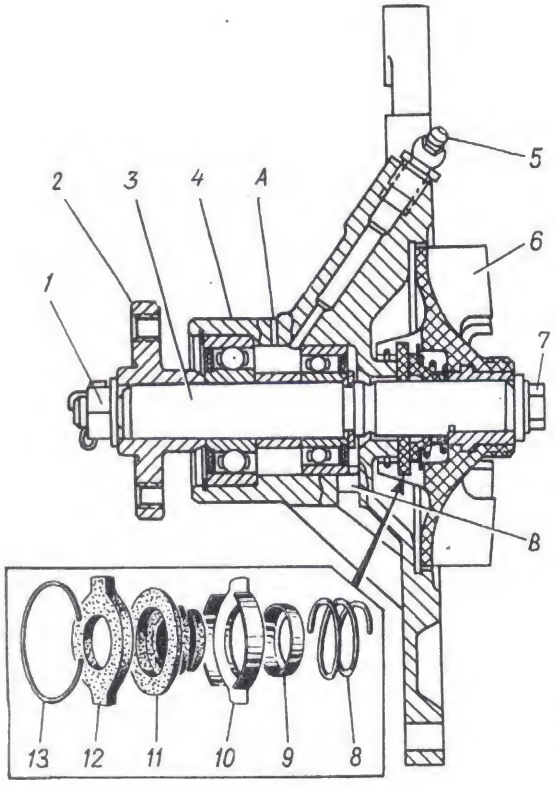

FIG. 10. WATER PUMP

1 – nut; 2 – hub; 3 – shaft; 4 – housing; 5 – lubrication fitting; 6 – impeller; 7 – bolt; 8 – spring; 9, 10 – oil seal shells; 11 – oil seal cup; 12 – oil seal washer; 13 – oil seal locking ring; A – lubricant outlet check port; B – check port for coolant outlet when oil seal is defective

Made in pump housing 4 are check ports A and B. Port A is used to remove old lubricant when lubricating the water pump bearings and port B, to prevent coolant from getting on bearings in case the oil seal is defective.

Lubricate the water pump bearings through lubrication fitting 5 until fresh lubricant comes from check port A. Remove the excess of lubricant as it results in decay of the drive belts. When the engine is running after lubrication of bearings, some lubricant may come from check port B; remove this lubricant.

Leakage of coolant through check port B indicates that the oil seal is defective. In this case the pump must be repaired. It is not allowed to dead-end check port B, otherwise the coolant may get onto and damage the pump bearings. To replace the components of the oil seal, remove the water pump housing from the timing gear cover, screw out bolt 7, and use the puller to remove impeller 6 from shaft 3.

To replace the water pump drive belts, uncotter the blower splined drive shaft and shift it towards the radiator, then release the tension roller and replace the belts. Even if only one of the belts is defective, replace both.

The belt tension is adjusted by changing the position of the tension roller. With a pressure of 4 kgf applied to the belt between the pump pulley and the tension roller, the belt sagging should range from 10 to 15 mm.

The fans create air blast in the cooling system. The vehicle engine compartment houses two six-bladed axial-flow fans mounted behind the radiators in special casings. The two fans and their fastening parts are similar in design.

The RH fan is driven by the water pump shaft through the splined shaft with two semirigid couplings. The LH fan is driven by the RH one through two V-belts. The tension of these belts is adjusted by displacing LH fan 3 (Fig. 11) along with casing 2 in which the fan is mounted. For this purpose, give the bolts that fasten casing 2 to the frame one or two turns back and use the nut of tension screw 1 to adjust the position of the casing and adjust the tension of the belts in accordance with the Diagram. Then tighten up the fastening bolts. If the belt tension cannot be adjusted any longer by means of the oblong holes made in casing 2, turn the casing through 180°. Besides, install tension screw 1 on the opposite side and change places of the plug and lubrication fitting on the fan bearing hub.

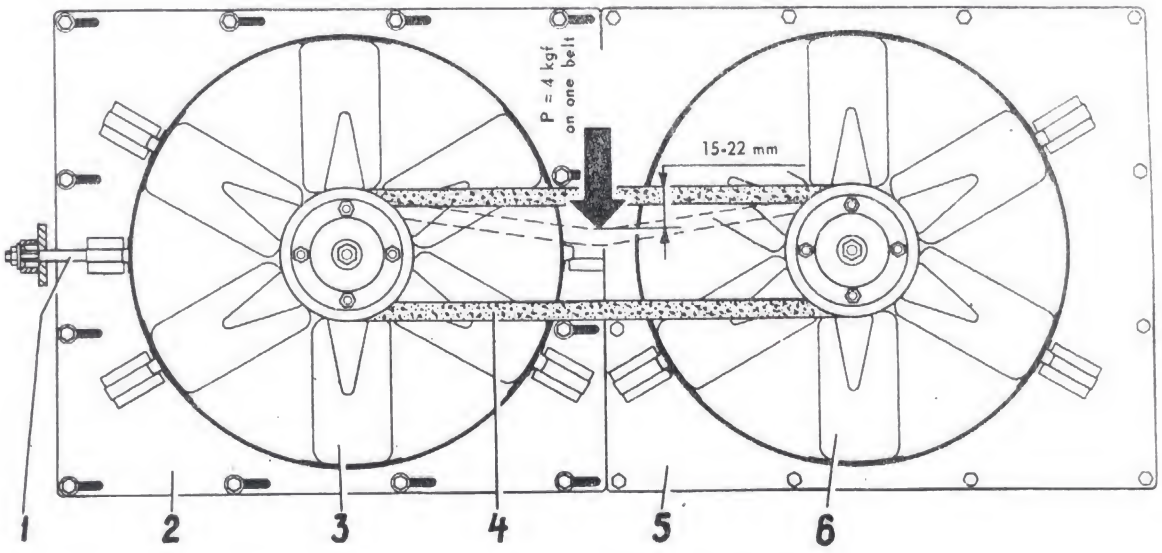

FIG. 11. FAN BELT TENSION DIAGRAM

1 – tension screw; 2 – left-side casing; 3 – left-side fan; 4 – belt; 5 – right-side casing; 6 – right-side fan

When one fan belt is torn, replace both belts at a time. A pair of belts must be chosen so that difference in their inner lengths is 2 mm maximum.

The heat exchangers are used for cooling the engine in the course of the vehicle operation on water, i.e. when the air inlet and outlet doors are closed.

The water and oil heat exchangers are mounted en block. Cooling is effected by outboard water.

Care of Cooling System

Fill the cooling system in summer with water and in winter with antifreeze.

To protect the cooling system from rust and coolant deposit, add a three-component additive of potassium bichromate (GOST 2652-72 or GOST 4220-75), sodium nitrite and trisodium phosphate (GOST 201-76)to cooling water. Add 50 g of each component to 100 ℓ of water. Add small portions of weighed components to boiled water at a temperature of 60 to 80°C and thoroughly mix. After the additive becomes dissolved, pour the coolant into the cooling system. Instead of the three-component additive, potassium bichromate alone may be used with the ratio of 400-800 g to 100 ℓ of water. Never use less than 300 g of potassium bichromate for 100 ℓ of water since such a solution imparts greater aggressiveness to corrosion.

It is permissible to put the additive directly into the cooling system through the filler hole of the expansion tank. In this case the powdered additive is brought inside when the engine is running and the temperature of water becomes as high as 40 to 60°C.

Add water as it evaporates from the solution during operation of the system. If the solution leaks through the joints, add the solution of initial concentration. Handle the three-component additive, potassium bichromate and their solutions with great care as they are poisonous.

Use solutions of water and ethylene glycol (antifreezes). Now two grease of such antifreezes are widely used: "65" and "40" with the freezing points of not above -65°C and -40°C, respectively. In winter the engine cooling system may be filled with water in exceptional cases only when no antifreezes are available.

Antifreezes if get into human stomach, cause intoxication. Therefore, take every precaution to prevent them from getting into food, the mouth, etc. Never suck antifreeze with the aid of a hose. Protect the engine cooling system from petroleum products (gasoline, kerosene, oil, and the like) since the latter make antifreeze foam heavily and escape from the cooling system. Replenish the cooling system with water only, since it evaporates earlier than ethylene glycol. In case of leakages, add antifreeze.

Drain coolant from the cooling system through three cocks: one on the heat exchanger, one on the starting preheater and one on the heater (near the bay of the front LH wheel). Prior to draining, open the expansion tank filler cap. Be careful in opening the cap on a hot engine, since excessive pressure in the cooling system will throw out liquid and steam that may cause severe burns.

The drain cocks should be closed in accordance with the instructions set forth on the instruction plates. If the cocks are not fully closed or leak, the water will seep and be frozen in the drain hose in winter. If this happened, clean the drain hose through a hole in the bottom prior to draining of water.

If the drain cock leaks, disassemble it, clean it of coolant deposit and lubricate with fat 1-13.

Maintenance of the engine cooling system includes the following operations to be performed.

1. Routine Inspection and Daily Maintenance include checking of the level of coolant and tightness of the cooling system joints.

2. Daily Maintenance includes checking of the fan belts for condition and tension.

3. Preventive Maintenance No. 1 (in addition to operations performed under Daily Maintenance) includes lubrication of the fan shaft and water pump shaft bearings.

4. Preventive Maintenance No. 2 (in addition to operations performed under Preventive Maintenance No. 1) includes:

(a) inspection of the expansion tank filler cap and checking of functioning of the cap valves and condition of the gaskets by pushing them with a finger;

(b) inspection of fastening of radiators and cleaning of radiators on the outside, if this is required.

5. Seasonal Maintenance includes the operations of the scheduled maintenance and, in addition, checking of oil supply to the rocker shafts.

Flushing of Cooling System

If during the summer-time operation of the vehicle the cooling system has been filled for some reasons with water less the three-component additive, the cooling system must be flushed prior to seasonal changing for winter-time operation.

To flush the cooling system, proceed as follows:

(a) drain water from the cooling system;

(b) fill the system with clean water containing the three-component additive;

(c) start and heat engine up to 80-90°C (with the heater engaged);

(d) drain the flushing solution completely two hours after the engine was stopped.

Fuel System

The fuel tanks (2 pieces) are installed in the rear of the vehicle, on the right and on the left, in two sections isolated from the engine compartment. The capacity of each tank is 140 ℓ.

The fuel tanks are brought inside through openings in the rear covered by hinged covers. The tanks are filled through small hatches provided in the rear of the vehicle.

Special casings with filler necks covered by threaded caps are secured on the hull rear plate and padded with rubber gaskets. The casings communicate with the fuel tanks through corrugated rubber hoses. Such arrangement prevents penetration of gasoline into the sections in the course of refuelling.

As the pressure inside the fuel tanks varies significantly, the filler cap is fitted with an inlet valve and an outlet valve through which the interior of the fuel tank may communicate with the atmosphere. The inlet valve opens when rarefaction in the fuel tank is as high as 45-350 mm H_2O and the outlet valve opens when pressure in the fuel tank becomes 300 - 430 mm H_2O.

The level of gasoline is checked by means of an electric fuel-level indicator located on the instrument board. The sending units of the indicator are positioned in both fuel tanks.

The tanks are also provided with mechanical indicators, that is, dipsticks placed in the tank filler necks. To know the amount of fuel left, see the digit groups stamped on the dipstick. Take the reading of the digit group whose first digit edge

is aligned with the fuel level. As to the amount of 140ℓ, the fuel level must be aligned with the notch beside digit group 140.

To switch fuel supply from the RH or LH tanks, a three-way fuel cock is mounted on the left upright of the fan casing. The tank selection cock control handle is installed in the fighting compartment. To switch over, follow the instructions set forth on the instruction plate.

The gravitation fuel filter (Fig. 12) consists of a body, cover and filter element.

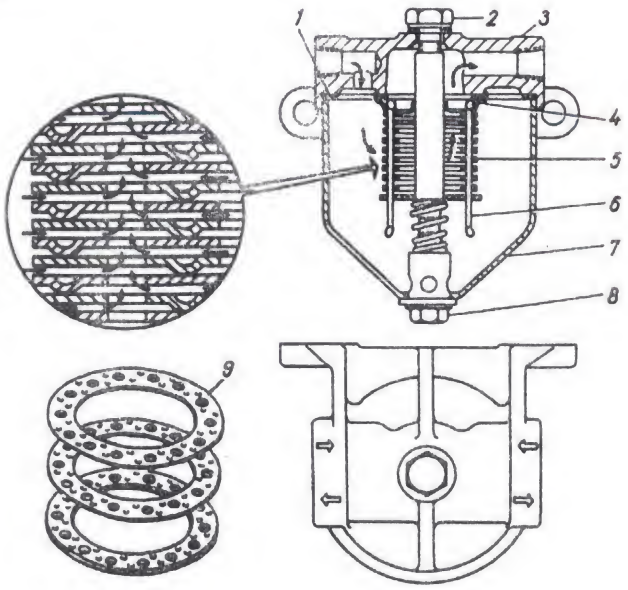

FIG. 12. GRAVITATION FUEL FILTER

1 – cover gasket; 2 – cover bolt; 3 – cover; 4 – filter element gasket; 5 – filter element; 6 – filter element holder; 7 – body; 8 – drain plug; 9 – filter plate

To clean the filter of dirt, screw out plug 8.

To flush the filter element, screw off bolt 2 on filter cover 3 and supporting body 7 from the bottom remove it together with filter element 5.

Upon flushing the filter element in gasoline, reinstall it together with the body, and tighten up bolt 2 on the cover.

During disassembly and reassembly of the filter see that the gaskets of the filter element and gravitation filter cover are not missing and that they are properly reinstalled. The absence of the gaskets or damage to the gaskets results in loss of tightness and in leakage of gasoline through the joints.

The fuel pump (Fig. 13) is installed on the right side of the engine. The pump has hand fuel feed lever 1 which is held in the lower position by a back-moving spring during the engine operation.

A gauze filter is mounted in the upper part of the fuel pump. It should be cleaned when this is necessary. Do not disassemble the fuel pump unless urgent need arises. As a rule, the pump troubles can be remedied by flushing or blowing through. To flush the pump filter, screw out two screws 3 and remove pump cover 4.

If, for some reason or other, the fuel pump has been disassembled, bring the diaphragm to the lower position by using hand fuel feed lever 1 prior to mounting the pump head on the pump housing.

The fine fuel filter is used for additional cleaning of fuel and ensuring reliable operation of the carburettor.

The gauze filter element should be washed in gasoline and blasted with compressed air (by directing the air jet to the inside of the element) at least once every 6000 km of run.

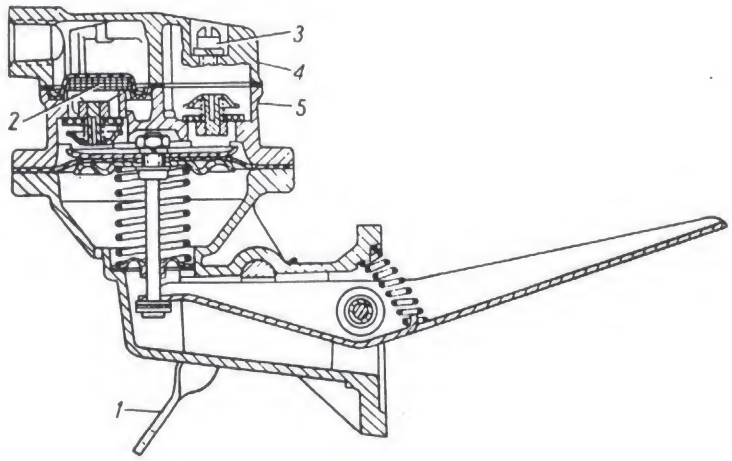

FIG. 13. FUEL PUMP

1 – hand fuel feed lever; 2 – filter; 3 – cover screw; 4 – cover; 5 – pump head

When assembling the filter, see that the gasket and the spring that supports the filter element are installed properly.

When reinstalling the filter sediment bowl, clamp it moderately with the wing nut fingertight.

The air cleaner is used to clean air supplied into the carburettor. It operates properly as long as the capron fibre of the filter filling is coated with a film of oil. When the filter element becomes dry, dust penetrates into the cylinders of the running engine and significantly increases wear of the engine. Used for the air cleaner is fresh or used, though surely settled, engine oil.

The air cleaner should be cleaned of dirt and washed in kerosene in terms specified by the present Manual. After washing, soak the filter element in oil and let excessive oil run off. Then fill the housing with 0.55 ℓ of oil and reinstall the filter element. To avoid inleakage of dust-laden air, make sure that the position of the gaskets and that of the air cleaner proper are correct.

Carburettor

Carburettor is a D-model, down-flow, balanced float-chamber carburettor.

Each carburettor chamber operates independently of the other and acts on four cylinders through the intake manifold divided by a partition into two branches. The RH chamber feeds cylinders 1, 4, 6 and 7; the LH one feeds cylinders 2, 3, 5 and 8.

To provide for normal operation of the engine under different conditions, the carburettor has the following metering systems:

1. Idling system.
2. Main metering system.
3. Economizer system.
4. Accelerating pump system.
5. Cold-engine starting system.

The idling, main metering and economizer systems (except for valve) are incorporated in each carburettor chamber. The accelerating pump and cold-engine starting systems are common for both carburettor chambers.

All major carburettor systems are based on the principle of air-pressure braking of fuel.

To start a cold engine, the mixture is enriched by partially closing choke valve 6 (Fig. 14).

As a result of closing the choke valve, high rarefaction is produced that leads to a more intensive flow of fuel in all the carburettor systems.

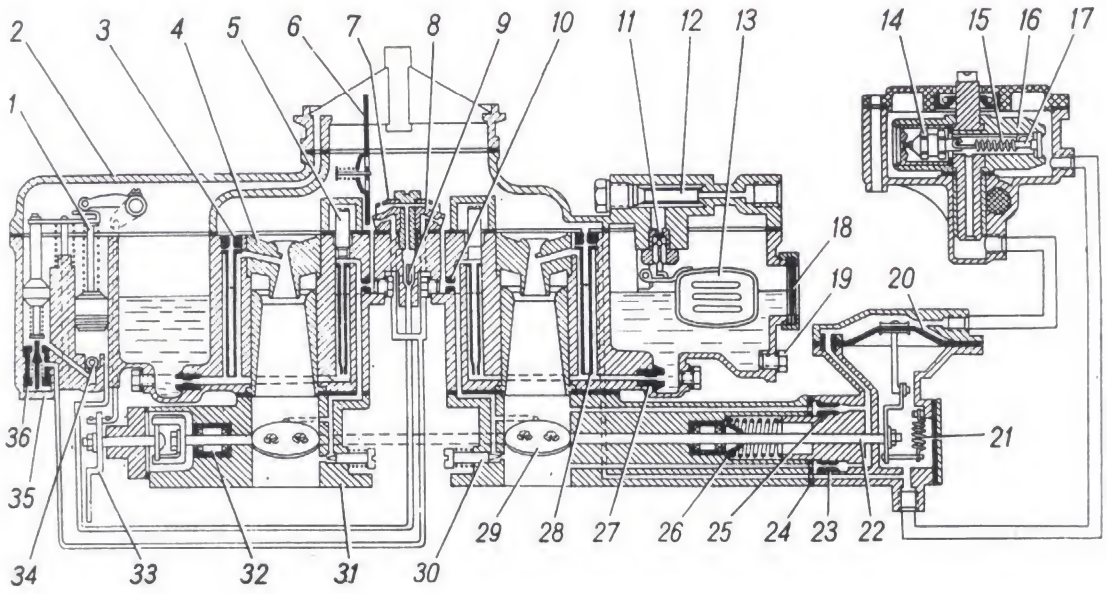

FIG. 14. CARBURETTOR AND SPEED GOVERNOR SENSOR

1 – accelerating pump; 2 – float chamber cover; 3 – main air jet; 4 – smaller barrel; 5 – idle fuel jet; 6 – choke valve; 7 – accelerating pump jet; 8 – economizer calibrated jet; 9 – delivery valve; 10 – idle air jet; 11 – fuel feed valve; 12 – fuel filter; 13 – float; 14 – sending unit valve; 15 – spring; 16 – sending unit rotor; 17 – adjusting screw; 18 – inspection hole; 19 – drain plug; 20 – diaphragm; 21 – limiter spring; 22 – throttle valves axle; 23 – vacuum jet; 24 – gasket; 25 – air jet; 26 – cup; 27 – main jet; 28 – emulsion pipe; 29 – throttle valve; 30 – idle adjusting screw; 31 – mixing chambers body; 32 – bearing; 33 – throttle valves lever; 34 – non-return valve; 35 – float chamber body; 36 – economizer valve

Excessive enrichment of the mixture after starting the engine with the choke valve closed is prevented by automatic air valves which dilute the mixture by admitting some more air.

Main Adjustment Data of Carburettor

Main fuel jet, cm^3/min	330 ± 4.5
Main air jet dia., mm	0.8
Idle fuel jet dia., mm	0.75
Idle air jet dia., mm	1.5
Idle hole in mixing chamber dia., mm	1.0
Economizer jet in valve body dia., mm	1.6
Economizer calibrated jet dia., mm	0.7
Diaphragm jets, cm^3/min:	
air jet	60 ± 2
vacuum jet	250 ± 7

Accelerating pump capacity ..... not less than 12 cm^3 per 10 piston strokes

Checking of fuel and air jets is performed by means of a special device or with hole gauges. The jet capacity in cm^3/min is checked with the pressure of 1000 mm H_2O at a temperature of 20°C.

Carburettor Adjustment

The level of fuel in the carburettor float chamber should be checked on a cold non-operating engine with the vehicle stationed on a level ground. Check the fuel level twice. In doing this, fill the float chamber with fuel by means of the hand fuel feed lever of the fuel pump and drain fuel after each checking through drain plug 19 (Fig. 14). The level of fuel should be surely within 18.5 to 21.5 mm from the float chamber-to-cover joint plane.

In case the level does not correspond to the above-mentioned requirements, remove the carburettor float chamber cover and adjust the float.

With the cover turned upside down, distance A (Fig. 15) between the top of the float and the cover-to-chamber joint plane should be 40-41 mm. Adjustment is carried out by bending reed 4 which thrusts against end face of valve needle 5. Besides, bend float travel limiter 2 to adjust the clearance B between the end face of needle 5 and reed 4 for 1.5 to 1.8 mm.

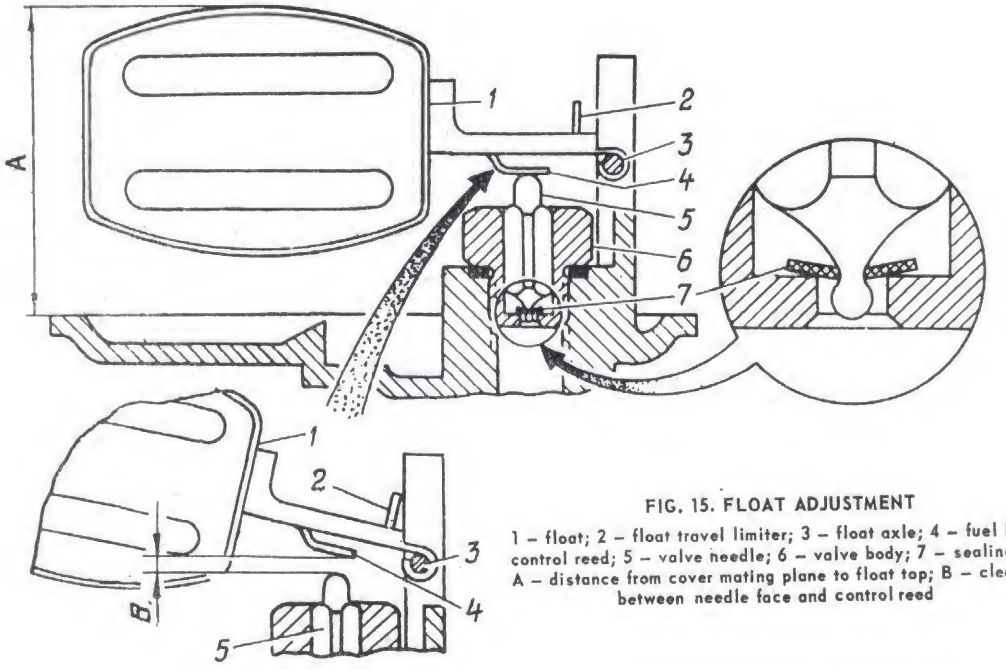

FIG. 15. FLOAT ADJUSTMENT

1 – float; 2 – float travel limiter; 3 – float axle; 4 – fuel level control reed; 5 – valve needle; 6 – valve body; 7 – sealing washer; A – distance from cover mating plane to float top; B – clearance between needle face and control reed

WARNING. While adjusting the float mechanism (particularly when bending reed 4 and limiter 2) take care that sealing washer 7 is not damaged.

If the adjustment does not give the desired result, check the carburettor float mechanism. Usually the causes of the abnormally high or low fuel level in the float chamber are loss of the float tightness, incorrect mass of the float, or faulty fuel feed valve (seizing of the valve in the opened or closed position).

Check the tightness of the float by immersing it into hot (at least 80°C) water and keeping it there for at least half a minute. Loss of tightness is indicated by bubbling of air. If this is the case, remove gasoline which might get into the float, and solder the float. Upon soldering, check the float for tightness again and weigh it. The mass of the float complete with its arm should be within 12.6-14 g. In case the mass of the float after soldering exceeds 14 g, remove excessive solder without disturbing the tightness of the float.

Wash the fuel feed valve in clean gasoline and blow it through with compressed air. If the valve is leaky, replace sealing washer 7.

After checking the parts of the float mechanism for condition, check the fuel level in the float chamber once more and adjust as described above, if required. To perform preliminary adjustment of the fuel level in the float chamber set the float in the position making the fuel feed valve close completely. In so doing, see that a distance A of 40-41 mm (see Fig. 15) is maintained.

Checking of the economizer for cutting-in is performed with the cover flange removed. In correctly adjusted economizer linkage, lever 3 (Fig. 16) should be turned so that the distance between the cover top plane and drive strip 1 is within 21.3--21.7 mm. While checking, use adjusting nut 2 to set a clearance of 3 mm between the nut face and the plane of drive strip 1.

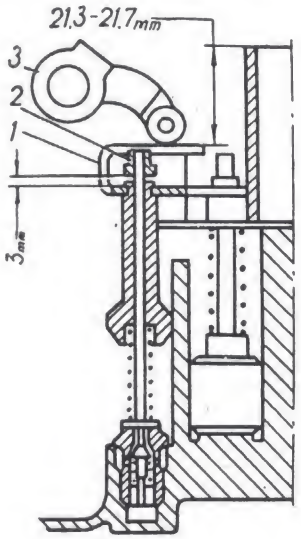

FIG. 16. CHECKING ECONOMIZER FOR CUTTING-IN

1 – drive strip; 2 – cutting-in rod adjusting nut; 3 – lever

Checking of the economizer valve for tightness may be carried out with the same device which is used for measuring the capacity of jets. The permissinle leakage at a pressure of 1000±2 mm H_2O is 4 drops per minute, maximum.

Checking of accelerating pump for capacity is carried out at a rate of 20 strokes per minute. Failure of the pump to meet the specified capacity is indicative of loose valves or clogged jets.

Idling adjustment is done by stop screw 1 (Fig. 17) which limits closing of the throttles and by two screws 2 which regulate proportioning of fuel and air.

The idling adjustment must be performed on the well-warmed engine having a sound ignition system. Particular attention should be paid to the condition of spark plugs and to the correct spark-plug gap. Prior to idling adjustment, check valve-to-tappet clearances on the cold engine.

When performing adjustment, bear in mind that mixture strength in D-model carburettors is controlled independently in each mixing chamber by separate adjusting screws 2. The mixture is enriched by turning these screws out and diluted by turning them in. To start the adjustment, screw in adjusting screws 2 right home (though not too tight) and then give each screw 2 1/2 turns back. This done, start the engine and turn stop screw 1 to get a stable engine speed with the minimum opening of the throttle. Then, by turning in or out one of idling mixture adjusting screws 2, set it in such a position which ensures the maximum speed of the crankshaft.

Similar operations are carried out with the second adjusting screw 2.

After more or less uniform operation of both carburettor mixing chambers is attained, reduce, if possible, the engine speed by turning out throttle stop screw 1. This done, repeat adjustment of mixture strength by screws 2. It is not advisable to set too low engine idling speed.

After two or three attempts, the correct position of the three adjusting screws will be found.

Having adjusted the carburettor, check the engine for proper adjustment and smooth idling. For this purpose, detach in succession ignition wire lugs from the spark plugs of groups of cylinders fed by one and the other carburettor chambers. For example, at first, cut off are cylinders 1, 4, 6 and 7 (RH chamber), then cylinders 2, 3, 5 and 8 (LH chamber). There must be no great difference in the operation of these cylinder groups (the speed difference should not exceed 60 r/min). Otherwise, additional adjustment is required to make operation of the two groups uniform. This is done by turning in or out adjusting screw 2 of the corresponding chamber with stop screw 1 undisturbed.

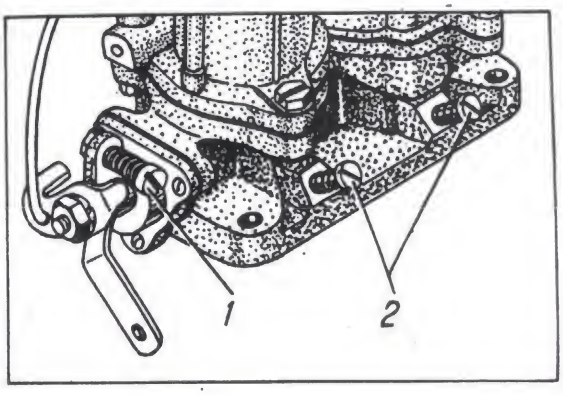

FIG. 17. IDLE ADJUSTING SCREWS
1 – throttle valve stop screw; 2 – idling mixture adjusting screws

It is permissible to let the engine run with only one group of cylinders supplied by the respective carburettor chamber only for a short time, 1 or 2 min, maximum. If the engine runs longer, the fuel and air mixture from the cut-off cylinders will get on the cylinder faces, wash down the lubricant and get into the engine crankcase. Eventually, the spark plugs get oiled and the engine service life is considerably reduced.

To check the adjustment, depress the accelerator pedal and instantly release it. If the engine stalls, slightly turn in screw 1 to increase the idling speed.

Adjustment of Throttle Opening with Choke Closed

If with the choke closed the throttles do not open through the required angle (which fact can adversely affect engine starting) because of the loose screw of adjusting plate 3 (Fig. 18) or bent rod 2, proceed as follows:

1. Warm up the engine and check it for proper adjustment of minimum smooth idling speed. Adjust it if necessary.
2. Loosen the fastening of adjusting plate 3 mounted on lever 4 of the accelerating pump control linkage.
3. Partially open the throttle valves by depressing the accelerator pedal through approximately 1/3 of its stroke.
4. Completely close the choke by pulling its button as far as it goes.
5. Hold the choke button and carefully close the throttle valves by smoothly releasing the accelerator pedal.
6. Use lever 1 to manually open the throttle valves and insert a 2.3-mm feeler gauge between thrust screw 7 and lever 1. Clearance A between the walls of the mixing chambers and throttle edges must be approximately 1.5 mm.
7. Shift adjusting plate 3 until it thrusts against the L-shaped projection of lever 5.
8. Secure adjusting plate 3 with the screw.
9. Open and close alternately the choke following the sequence set forth in Items 3 through 5 and check the throttle valves for proper adjustment by making use of the value of clearance B between thrust screw 7 and lever 1 (which must be 2 to 2.5 mm).

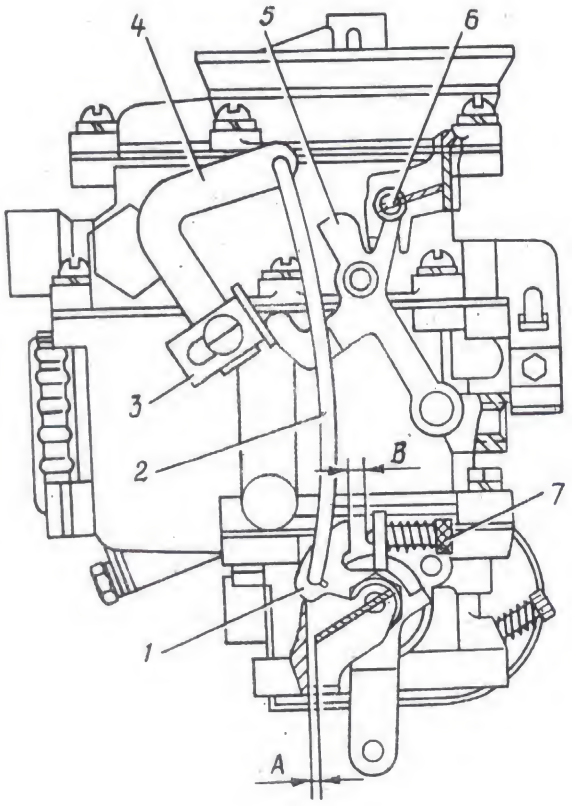

FIG. 18. ADJUSTMENT OF THROTTLE OPENING WITH CHOKE CLOSED

1 – throttle valve lever; 2 – rod; 3 – adjusting plate; 4 – lever of accelerating pump control linkage; 5 – lever of choke control linkage; 6 – choke axle; 7 – thrust screw
A – clearance between walls of mixing chambers and edges of throttle valves; B – clearance between lever of throttle valves and thrust screw

Speed Governor

The speed governor is designed to prevent the engine crankshaft from overspeed which may lead to premature wear of engine parts, breakage of certain components and excessive consumption of fuel.

The pneumatic-centrifugal speed governor incorporates a sending unit mounted on the timing gear cover and driven by the camshaft, and an actuating mechanism built in the mixing chamber of the carburettor. The actuating mechanism actuates the carburettor throttles through axle 22 (Fig. 14).

The sending unit is connected with the actuating mechanism by two pipes. If the speed governor is inoperative, centrifugal valve 14 of the sending unit is open. In this case the cavity over diaphragm 20 is connected with the carburettor air scoop. As a result, depression transmitted from the mixing chamber via jet 23 is balanced, and the diaphragm remains in its initial position.

As the engine speed increases, centrifugal valve 14 overcomes the resistance of spring 15 and gets closed. The depression in the mixing chamber is transmitted into the cavity over the diaphragm via a system of channels and jet 23. The cavity under the diaphragm remains connected with the carburettor air scoop.

Due to depression, the diaphragm overcomes the resistance of actuating mechanism spring 21 and closes throttles to a certain degree thus maintaining the required engine speed.

If the speed governor operates properly, the crankshaft speed of a serviceable engine will not exceed 3650 r/min and the maximum speed of the vehicle driven on a flat level section of hard-surface road will be 95 to 100 km/h.

The speed governor bears a seal and may not be disassembled within the guaranteed life.

It is impermissible to let the engine run with the speed governor pipes disconnected. It is equally impermissible to unseal the actuating mechanism of the speed governor installed on the carburettor, and the sending unit installed on the timing gear cover.

Care the speed governor needs it to keep it clean and lubricate the sending unit during Preventive Maintenance No. 1.

Accelerator

The carburettor throttle valves are connected with the accelerator pedal through a linkage system. The accelerator pedal shaft is mounted in two plastic bushings. The throttle valves are also provided with a manual control.

The buttons of choke and throttle flexible cables are located in the floor recess to the right of the driver's seat. When pulled out, the buttons should remain in any chosen position and, when pushed in, may fail to reach the home position due to the considerable length of the cables, though by not more than 3 mm.

To facilitate use of the throttle button, first depress the accelerator pedal.

Care of Fuel System

Cleanliness is the main requirement ensuring normal operation of the fuel system. Fill the fuel tanks with clean fuel only. Refuelling vessels should be clean and the filling funnel must be fitted with a gauze filter.

When refuelling, take every precaution to prevent contamination of fuel tanks. Never leave filler necks open. Tighten up the threaded caps to prevent fuel outflow.

After operation on water, screw out the plugs located below the fuel tanks and drain water from the tank sections. After the long run on dusty and dirty roads and at least during the Seasonal Maintenance in autumn, flush the sections and dry them.

Maintenance of the fuel system includes the following operations to be performed.

1. Routine Inspection of the fuel system includes:

(a) checking of the fuel level and topping-up if necessary;

(b) checking the fuel system for leakage and stopping of leakage, if any.

2. Daily Maintenance, besides the above operations, includes:

(a) checking of the air cleaner-to-carburettor joint for tightness;

(b) cleaning and washing of the carburettor air cleaner and renewal of oil in the latter after operation under dusty conditions. If the vehicle operated under heavily dust-laden air conditions, the air cleaner should be washed every 100 km of run.

3. Preventive Maintenance No. 1, in addition to the Daily Maintenance operations, includes:

(a) cleaning of the carburettor air cleaner and renewal of oil in the latter;

(b) checking of the carburettor fastening to the intake manifold;

(c) lubrication of the speed governor sending unit.

4. Preventive Maintenance No. 2, besides the operations under Preventive Maintenance No. 1, includes:

(a) draining of sludge from the gravitation fuel filter and washing of its filter element every 6000 km of run;

(b) checking for gas permeation through the exhaust manifold flanges and gaskets and tightening of nuts, if necessary;

(c) washing of the fine fuel filter in gasoline and blowing it with compressed air (during every other Preventive Maintenance No. 2);

(d) checking the intake manifold for fastening and tightening of nuts, if required (during every other Preventive Maintenance No. 2);

(e) blowing through the carburettor idle air and fuel jets with compressed air (during every other Preventive Maintenance No. 2). To this end, remove the carburettor air cleaner and proceed as follows:

- use the screwdriver to screw out two idle fuel jets 1 (Fig. 19) and blow them through;

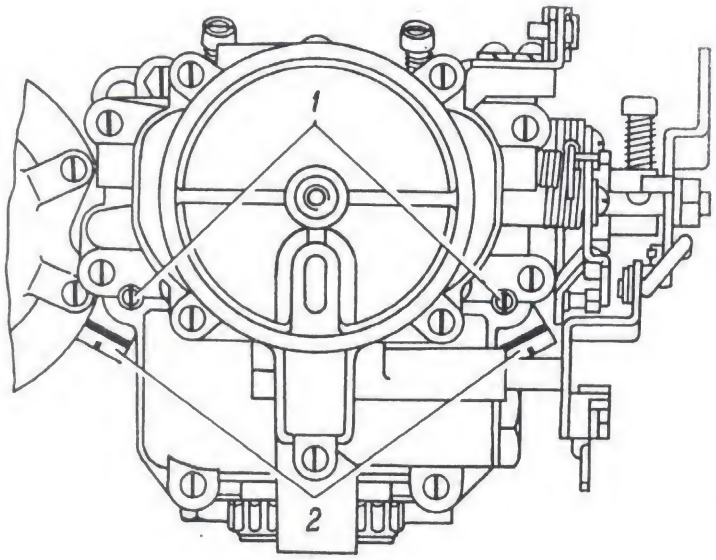

FIG. 19. CARBURETTOR K-126M (PLAN VIEW)
1 – idle fuel jets; 2 – idle air jet plugs

- screw out two plugs 2 covering the idle air jets;
- screw out two idle air jets, blow through and reinstall them;
- reinstall plugs 2; see that the gaskets are surely placed under the plugs;
- screw in both idle fuel jets 1; do not apply excessive effort to avoid damage to the jets;
- reinstall the carburettor air cleaner, start the engine and check its operation at minimum idling speed.

5. Seasonal Maintenance (in autumn) includes:

(a) flushing of fuel tank sections with water;

(b) draining of sediment from both fuel tanks, flushing of the gravitation fuel filter and fine fuel filter;

(c) disconnecting and drawing of the choke and throttle control cables out of their sheaths, washing of them in kerosene and insertion back into their sheaths after passing them through a rag greased with ЦИАТИМ-201. If the cable fails to enter its sheath (when sheath coils are warped), remove the sheath, remedy the fault, wash it in kerosene, insert the cable into the sheath as described above and fasten it in its initial position;

(d) maintenance of carburettor. Within its scope, proceed as follows:

- remove carburettor, disassemble* it, clean all parts of dirt and remove gum from them;
- check capacity of jets with special devices;
- reinstall the carburettor and make sure that all the carburettor-to-pipe joints are tight;
- check the fuel level in the float chamber;
- adjust idling speed.

ENGINE TROUBLES AND REMEDIES

Symptom and cause	Remedy
Engine Fails to Start	
No fuel supply or insufficient supply	
(a) damaged diaphragm, clogged valves or poor tightness in joints of fuel pump;	Check fuel pump and remedy fault (replace diaphragm, clean and wash valve seats, tighten cover screws)
(b) clogged gravitation fuel filter, fine fuel filter, filters in carburettor, fuel pump and fuel tank;	Clean and wash filters
(c) frozen water in gravitation fuel filter or fuel pipes;	Heat up gravitation fuel filter or fuel pipes with hot water, drain sludge and water
(d) inleakage of air in fuel pipeline joints	Check tightness of pipeline joints, stop inleakage of air
No spark is produced by spark plugs:	
(a) broken primary circuit;	Check circuit and connections
(b) breaker points fail to close or are burnt;	Clean breaker points and adjust gap between them
(c) ignition switch is cut off;	Eliminate fault and cut in ignition switch
(d) faulty voltage divider;	Replace voltage divider
(e) damaged ignition coil (secondary circuit);	Replace ignition coil
(f) high-tension cable running from ignition coil to ignition distributor is torn or short-circuited to armour braiding;	Replace cable
(g) damaged distributor rotor or cap;	Replace damaged part
(h) breaker points fail to open	Inspect textolite journal of breaker movable contact; if worn out, replace it; adjust gap between breaker points

* Only the carburettor specialist may be entrusted with disassembly and adjustment of the carburettor.

Symptom and cause	Remedy
No spark is produced by spark plugs. Voltammeter pointer rests at extreme left division, indicating discharge of storage battery:	
(a) short-circuited primary circuit;	Replace faulty wire or insulate bare section of wire
(b) short-circuiting of breaker movable contact to ground;	Check insulation of breaker movable contact; replace faulty movable contact
(c) short-circuiting in primary winding of ignition coil;	Replace ignition coil
(d) break-down of capacitor	Replace capacitor
Spark produced by spark plugs is too weak: damaged or dirty primary circuit connections (burnt breaker points, faulty ignition coil cable connections)	Check and clean breaker points, adjust gap, restore connections
Unsteady Engine Slow-Running	
Lean fuel mixture (backfire):	
(a) incomplete closure of choke during engine starting;	Check and adjust choke linkage
(b) clogged carburettor jets;	Wash jets and blow them through with compressed air
(c) inleakage of air in carburettor-to-intake manifold or intake manifold-to-cylinder block joint	Eliminate air inleakage
Rich fuel mixture (back-shot): leaky fuel feed valve	Replace valve packing washer
Incorrect carburettor idle adjustment	Adjust carburettor idling
Water in fuel	Drain sludge from fuel tanks and gravitation fuel filter
Clogged carburettor idling system	Screw out, wash and blow through clogged metering element with compressed air
Misfire in ignition system: oily (sooted) spark plug electrodes, incorrect spark gap, damaged spark plug insulators or ignition cable insulation	Clean, wash spark plug electrodes, adjust spark gap, replace faulty spark plugs or cables
Engine Fails to Develop Full Power	
Insufficient filling of cylinders with fuel-air mixture:	
(a) incomplete opening of carburettor throttle valves;	Check and adjust throttle linkage, if necessary
(b) incomplete opening of carburettor choke;	Adjust choke linkage

Symptom and cause	Remedy
(c) dirty air cleaner;	Wash air cleaner and refill it with fresh oil
(d) incorrect valve-to-tappet clearances	Adjust valve-to-tappet clearances
Lean gas mixture:	
(a) insufficient fuel level in float chamber;	Adjust fuel level in float chamber
(b) seizure of fuel feed valve;	Wash valve
(c) clogging of carburettor metering elements;	Screw out clogged metering element, wash it in gasoline or acetone and blow through with compressed air
(d) improper functioning of economizer valve	Inspect valve and, if necessary, screw it out carefully, wash in gasoline, blow it through with compressed air and check for tightness
Low compression ratio in cylinders: worn-out cylinders, worn or scorched piston rings, sticking or loose seating of valves	Send engine for repair
Erratic firing:	
(a) incorrect timing;	Adjust engine timing
(b) faulty centrifugal automatic spark timer	Replace ignition distributor
Poor Engine Response	
Malfunctioning of carburettor accelerating pump: on sharply opening throttle, engine picks up slowly, backfire takes place	Eliminate jamming of accelerating pump piston linkage
Engine Overheats	
Insufficient cooling:	
(a) closed air inlet and outlet doors;	Open air inlet and air outlet doors
(b) insufficient level of coolant in cooling system;	Pour in coolant up to required level; check hose joints, water pump oil seal, radiators and heat exchanger for water leakage
(c) radiators are covered with dirt;	Blast radiators with compressed air or clean them on the outside
(d) slipping of fan drive belts;	Adjust belt tension
(e) faulty thermostat (valve fails to open)	Replace thermostat
Late ignition	Adjust engine timing

Continued

Symptom and cause	Remedy
Engine Knocks	
Advanced ignition	Adjust for later ignition
Detonating combustion of mixture:	
(a) wrong type of fuel is used;	Replace fuel or set late ignition
(b) engine is overheated;	See Para "Engine Overheats"
(c) carbon deposit in combustion chambers	Take off cylinder heads and remove carbon deposit
Incorrect (excessive) clearance between valves and rockers	Check and adjust clearances between valves and rockers
Heavy wear or melting-out of crankshaft or crankpin bearings	Send engine for repair
Heavy wear of pistons, cylinder liners, piston pins	
Excessive Fuel Consumption	
Fuel leakage through fuel system loose joints	Check joints and eliminate fuel leakage
High level of fuel in carburettor float chamber	Adjust for correct fuel level
Incomplete opening of air choke	Adjust air choke linkage
Seizure of economizer system mechanisms	Screw out, wash and blow with compressed air economizer valve, then check it for tightness
Late ignition	Adjust ignition
Dirty air cleaner	Wash air cleaner and refill it with fresh oil
Excessive Oil Consumption	
Heavily worn out or scorched (carbonized) piston rings	Send engine for repair
Leakage of oil in crankcase joints, pipe joints, or oil seals	Eliminate leakage by tightening joints or replacing packing
Low Oil Pressure	
Low oil level in crankcase	Replenish oil to normal level
Engine overheats	See Para "Engine Overheats"
Excessive wear of crankpin and crankshaft bearing shells	Send engine for repair

Continued

Symptom and cause	Remedy
Oil Pressure Gauge Indicates Zero Oil Pressure (shut down the engine immediately)	
Faulty pressure gauge or oil pressure sending unit	Replace faulty instrument
Faulty oil pump	Replace or repair oil pump
Broken hoses or pipes of lubricating system	Replace damaged hoses (pipes)
Damaged oil coolers	Repair or replace oil coolers

Chapter 3

TRANSMISSION

The vehicle transmission (Fig. 20) serves to convert and transmit the engine torque to the driving (front and rear) and auxiliary wheels, the water-jet propeller and the winch.

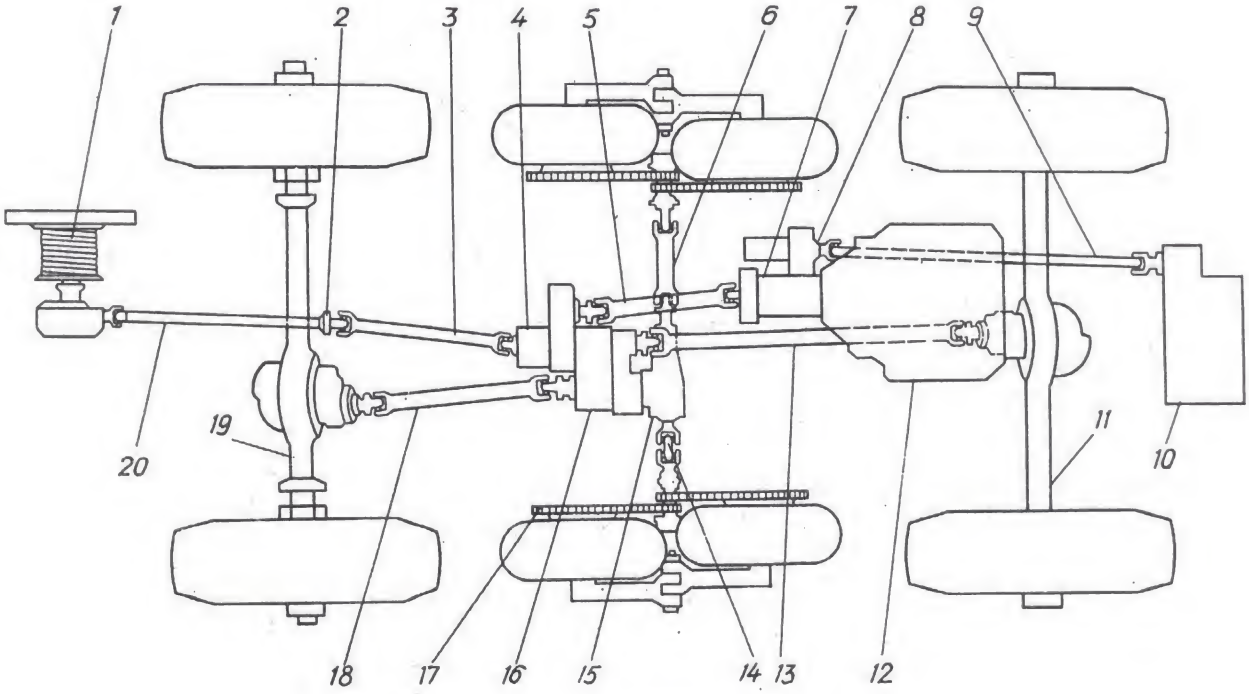

FIG. 20. TRANSMISSION LAYOUT

1 – winch; 2 – intermediate bearing; 3, 20 – winch drive propeller shafts; 4 – winch power take-off; 5 – intermediate propeller shaft; 6, 14 – auxiliary wheels drive propeller shafts; 7 – gearbox; 8 – water-jet power take-off; 9 – water-jet drive propeller shaft; 10 – water-jet propeller with reduction gear; 11 – rear driving axle; 12 – engine and clutch; 13, 18 – propeller shafts of driving axles; 15 – auxiliary wheels power take-off; 16 – transfer; 17 – auxiliary wheels chain drive; 19 – front driving axle

The transmission of vehicle БРДМ-2 incorporates the clutch, gearbox coupled with the water-jet propeller power take-off, transfer coupled with the auxiliary wheels power take-off and winch power take-off, front and rear axle drive shafts and propeller shafts, water-jet propeller reduction gear and propeller shaft, winch propeller shaft, and auxiliary wheels propeller shaft and chain drive.

CLUTCH

A spring-loaded single-loaded single-plate dry-disk damper-type clutch is mounted on the engine flywheel.

The clutch incorporates a pressure plate assembly (driving member), clutch driven disk assembly, clutch release mechanism, clutch upper housing 2 (Fig. 21) attached to the engine cylinder block and clutch lower housing 13.

Clutch cover plate 12 is attached to flywheel 1 by six special centering bolts. The centering lugs of pressure plate 4 engage the openings of the cover plate. Through these lugs engine torque is transmitted to the pressure plate.

Pressure on the facings of driven disk 3 is exerted by twelve springs 11 mounted between cover plate 12 and pressure plate 4. Springs 11 thrust against pressure plate 4 through the heat-insulating washers. When the clutch is engaged, driven disk 3 is pressed between flywheel 1 and pressure plate 4 by springs 11. Engine torque is thus transmitted to gearbox input shaft 10.

The clutch release mechanism connected to pressure plate 4 consists of three levers 5 with needle bearings mounted in the hinges, and three forks. Used as the support for each lever is nut 6 screwed on the lever fork.

By turning these nuts in or out, the levers are adjusted for simultaneous action of the clutch release bearing of sleeve 9 on the above levers when releasing the clutch. After the adjustment, the nuts are stop punched, and the levers normally need no adjustment when the vehicle is in the service.

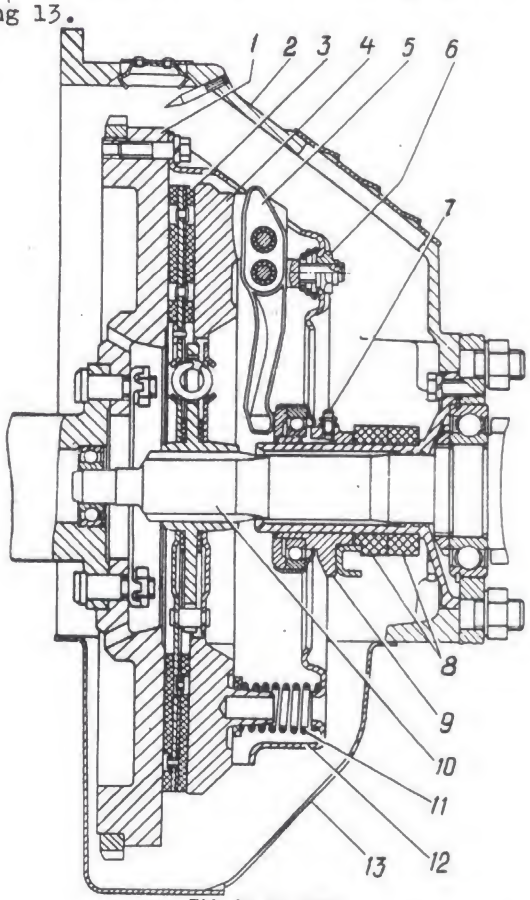

FIG. 21. CLUTCH

1 – flywheel; 2 – clutch upper housing; 3 – driven disk; 4 – pressure plate; 5 – pressure plate lever; 6 – adjusting nut; 7 – lubrication fitting; 8 – protecting rings (2 pcs); 9 – clutch release sleeve; 10 – gearbox input (primary) shaft; 11 – thrust spring; 12 – clutch cover plate; 13 – clutch lower housing

In releasing the clutch, sleeve 9 is shifted in the direction of the flywheel by fork 15 (Fig. 22) which rests on the pin screwed on the clutch housing.

The sleeve interior is protected from dust and clutch wear products by two protecting rings 8 (see Fig. 21) made of porolon.

The bearing of clutch release sleeve 9 is lubricated with lubricant Л3-31 GOST 5.575-70 at the Manufacturer's plant and not to be lubricated during operation. Lubrication fitting 7 on the sleeve is designed to receive some lubricant* after 20,000 km of run or in five years of operation (storage) of the vehicle. Lubricant is added in 14 strokes of the grease gun. After the first seven strokes the bearing should be turned through half a revolution.

Pressure plate 4 and cover plate 12 are jointly balanced with the engine crankshaft and flywheel. Therefore, if repair is being performed, align mark "0" on flywheel 1 with that on cover plate 12 to assemble the clutch properly.

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* If lubricant Л3-31 is not available, it is permissible to use lubricant ЦИАТИМ-201.

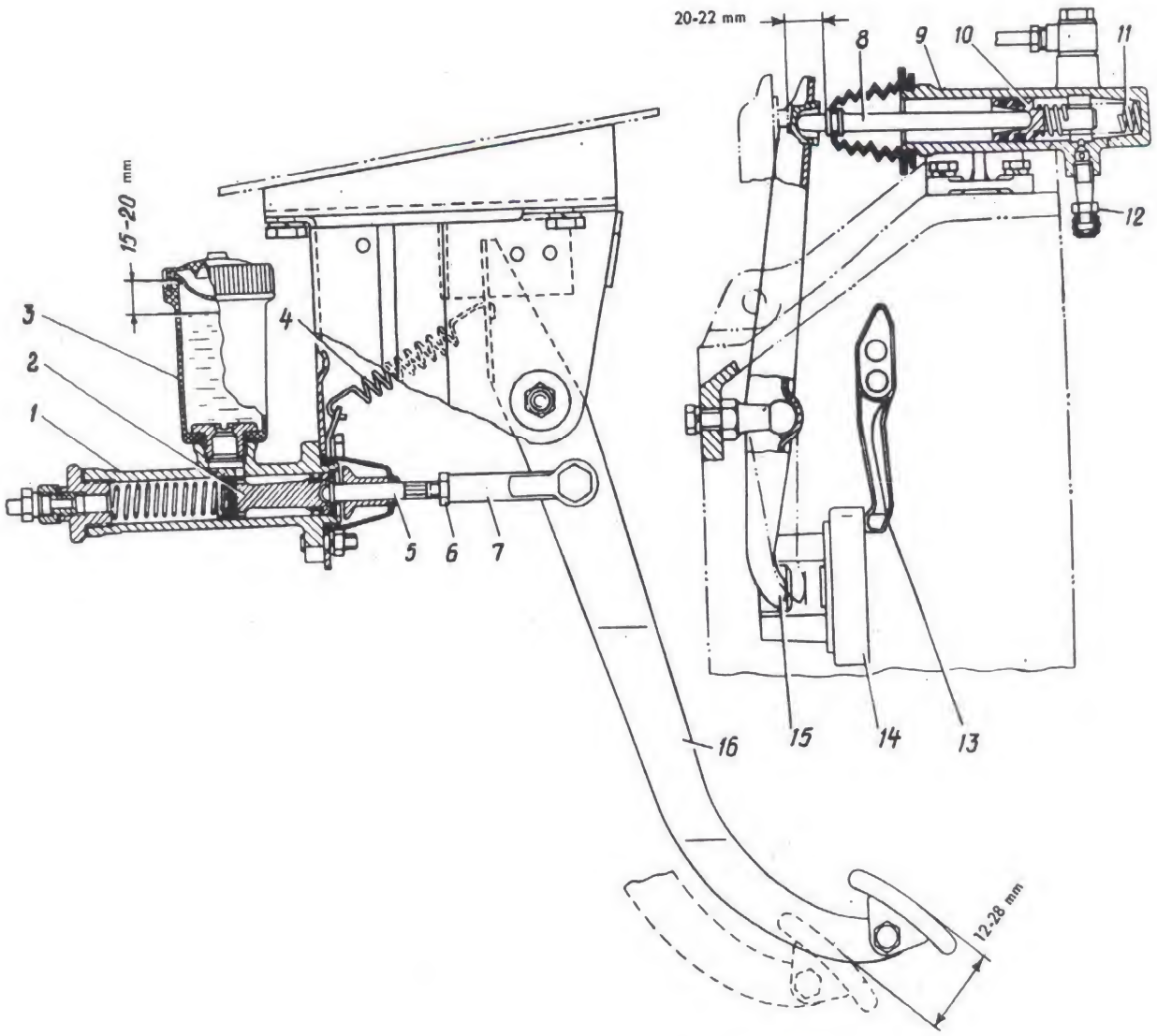

FIG. 22. CLUTCH CONTROL

1 – master cylinder; 2 – master cylinder piston; 3 – tank; 4 – back-moving spring; 5, 8 – push rods; 6 – lock nut; 7 – coupling rod; 9 – clutch release cylinder; 10 – clutch release cylinder piston; 11 – spring; 12 – by-pass valve; 13 – pressure plate lever; 14 – bearing; 15 – fork; 16 – pedal

Driven disk 3 consists of a hub, a damper mounted on the hub and facings riveted to the disk, the rear facing being secured to the disk through spring straps. The damper is designed to dampen torque vibrations produced by the vehicle transmission.

When driving the vehicle, the driver should not rest the foot on the clutch pedal to avoid constant clutch slip which results in premature wear or burning of the facings and damage to the clutch release bearing.

Clutch Control

Clutch control is hydraulic. It incorporates suspended pedal 16 (Fig. 22), master cylinder 1, clutch release cylinder 9 and the pipeline.

The clutch pedal and the service brake pedal form a pedal unit positioned on the detachable bracket. The pedals are suspended on the axle fitted with plastic bushings that require no lubrication. Spring 4 holds clutch pedal 16 in the extreme rearward position. Master cylinder 1 is attached to the detachable bracket and is connected with pedal 16 through push rod 5 and coupling rod 7. The movable connection of rod 7 and pedal 16 jointed by a special bolt needs no lubrication.

Master cylinder 1 houses piston 2 fitted with the gland. Tank 3 is mounted atop the master cylinder.

Clutch release cylinder 9 is attached to the clutch housing by means of bolts. The cylinder body houses piston 10 fitted with the packing ring and gland. Spring 11 presses the piston to the extreme forward position so that bearing 14 is pressed to levers 13 without clearance. Valve 12 covered by a rubber cap is screwed in the clutch release cylinder. The valve is used to bleed air from the clutch control hydraulic system.

Filling of Clutch Control Hydraulic System with Operating Fluid and Air Bleeding

Used as operating fluid in the hydraulic system is oil AMT-10. To fill the clutch control hydraulic system with operating fluid or to bleed air that entered the hydraulic system, proceed as follows:

(a) screw out the bolts and open the access door over the clutch control master cylinder;

(b) screw out the cap of master cylinder tank 3 and pour operating fluid to the level of 15 to 20 mm below the upper edge of the tank;

(c) remove the cap of by-pass valve 12 of the clutch release cylinder and install instead the rubber hose for bleeding air from the service brake system; dip the free end of the hose into oil AMT-10 contained in a half-filled glass vessel;

(d) give 1/2 to 3/4 turn back, to by-pass valve 12, depress clutch pedal 16, screw the by-pass valve in and release the pedal (the pedal should be depressed rapidly but released slowly). Repeat the procedure until air bubbling from the hose brought into the vessel comes to the end. Do not dry out the tank for in this case air may penetrate again into the clutch control hydraulic system;

(e) upon bleeding, replenish tank 3 to the level of 15 to 20 mm below the upper edge of the tank, and screw on the cover;

(f) check clutch pedal 16 for free travel which should be within 12 to 28 mm. The pedal free travel in excess of 28 mm will indicate the presence of air in the hydraulic system and necessity of repeated air bleeding;

(g) remove the hose from by-pass valve 12 and put the cap in its place;

(h) close the access door over the clutch control master cylinder and place home the fastening bolts.

Adjustment of Clutch Control

During the period the vehicle is in the service there is no need for any scheduled adjustment of the clutch control. Free travel of the clutch pedal (12 to 28 mm) is ensured by the design of the clutch control master cylinder and will not be adjusted in the process of operation.

As the facings of the clutch driven disk are getting worn, piston 10 changes its position in clutch release cylinder 9 due to action of spring 11 and provides for constant pressing of bearing 14 to levers 13 through clutch release fork 15.

The necessity to adjust the clutch control arises only when the engine, the clutch or the clutch control unit have been replaced.

To perform the adjustment, proceed as follows:

(a) fill the clutch control hydraulic system with operating fluid and bleed air from the system as described above;

(b) depress the pedal as far as it will go and check the clutch release cylinder piston stroke which should be 20 to 22 mm (Fig. 23).

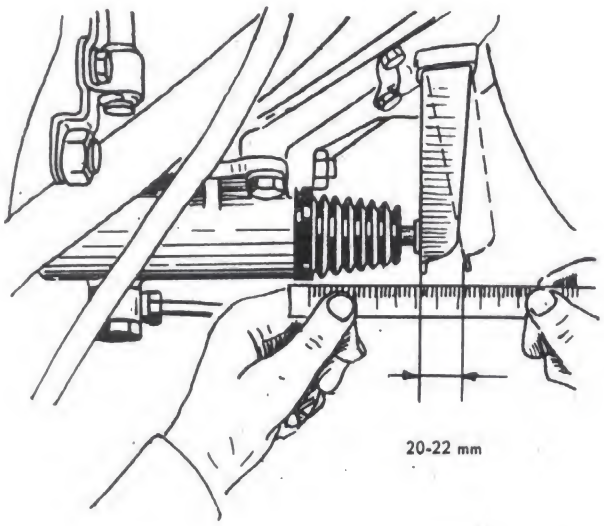

FIG. 23. CHECKING OF CLUTCH RELEASE CYLINDER PISTON STROKE

If necessary, adjust the piston stroke by varying the length of master cylinder piston push rod 5 (see Fig. 22) and then lock it with lock nut 6.

GEARBOX

The gearbox (Fig. 24) provides four forward speeds and one reverse. The gear case is a cast iron casting fastened to the clutch housing by studs. Made in the gear case RH wall (when viewed from the rear of the vehicle) is an opening for mounting the water-jet propeller power take-off.

Gearbox primary shaft 4 is made integral with skew gear 5. The primary shaft is installed in the front wall of the gear case in the ball bearing and in the bearing located in the engine crankshaft front end.

Mounted on the front splined end of secondary shaft 24 is synchronizer 3. The synchronizer serves for easy and smooth engagement of the third and fourth speed gears. Second speed gear 20 and third speed gear 19 which are in constant meshing with the countershaft rotate freely in the middle portion of the secondary shaft, while gear 21 of the first and the reverse speed gears moves along the secondary shaft splines. The rear end of the secondary shaft mounts the distance bushing and the propeller shaft holding flange. The secondary shaft rests in two bearings: the cylindrical roller bearing located in the recess of the primary shaft and the ball bearing mounted in the gear case rear wall.

Countershaft 2 which is essentially a cluster gear including three skew gears 1, 29 and 28 and one spur gear 26 rotates in two bearings: one roller bearing and one ball bearing.

Reverse speed cluster gear 27 that consists of two gears is located in the left part of the gearbox (when viewed from the rear of the vehicle) a little higher than the countershaft axis. It rotates in roller bearings mounted on a stationary axle.

All gears, except the first and reverse speed gears, are held in constant meshing. Friction surfaces are lubricated by splashing during rotation of the countershaft. The gear case bottom has dirt trap 31.

Gear shifting is effected by sliding the synchronizer sleeve or the first and reverse speed gears along the secondary shaft and by bringing them in meshing with the corresponding gears. Engagement of the reverse speed gear is effected by sliding reverse speed cluster gear 27.

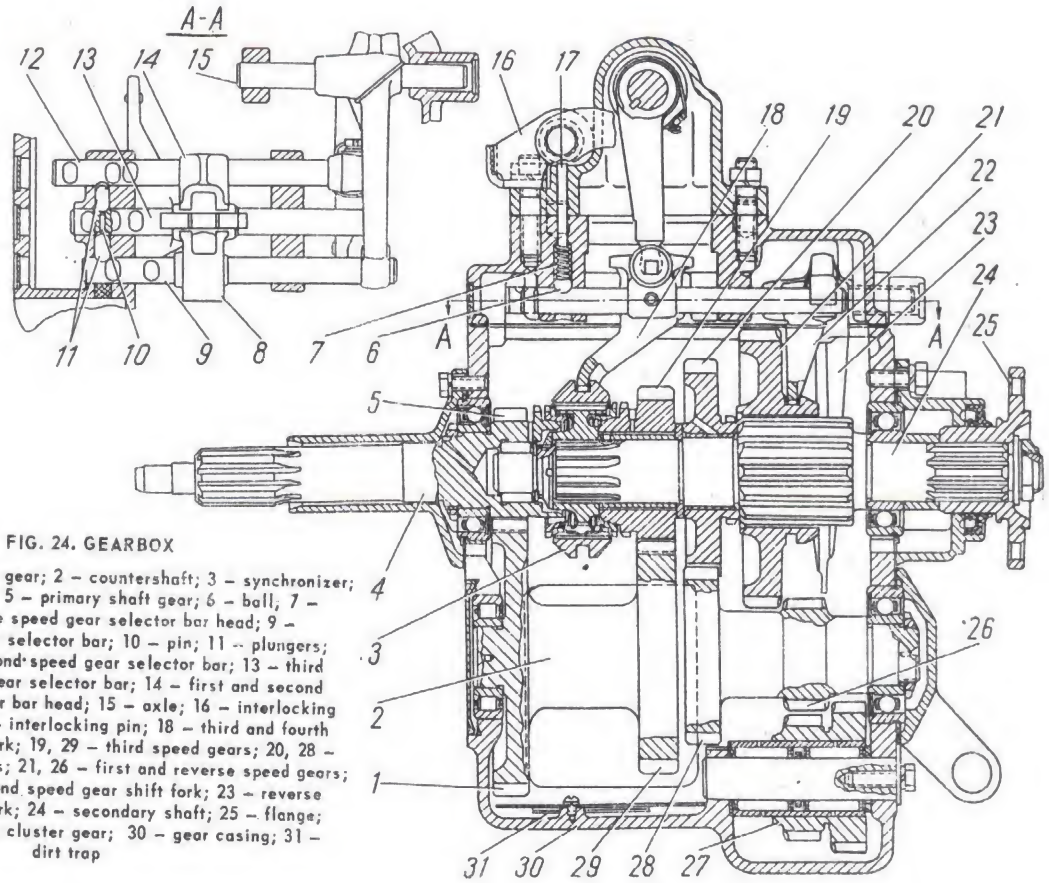

FIG. 24. GEARBOX

1 – constant-mesh gear; 2 – countershaft; 3 – synchronizer; 4 – primary shaft; 5 – primary shaft gear; 6 – ball; 7 – spring; 8 – reverse speed gear selector bar head; 9 – reverse speed gear selector bar; 10 – pin; 11 – plungers; 12 – first and second speed gear selector bar; 13 – third and fourth speed gear selector bar; 14 – first and second speed gear selector bar head; 15 – axle; 16 – interlocking shaft bracket; 17 – interlocking pin; 18 – third and fourth speed gear shift fork; 19, 29 – third speed gears; 20, 28 – second speed gears; 21, 26 – first and reverse speed gears; 22 – first and second speed gear shift fork; 23 – reverse speed gear shift fork; 24 – secondary shaft; 25 – flange; 27 – reverse speed cluster gear; 30 – gear casing; 31 – dirt trap

The synchronizer (Fig. 25) is of an inertia type. It incorporates hub 5, sleeve 2, two brass tapered rings 8 with the outer toothed rim, three retainers 7, and two ring springs 3.

In the process of putting in the gear, retainers 7 exert initial pressure on tapered rings 8. Each retainer is at the same time in the synchronizer hub spline and in the spline of the tapered ring, the latter being somewhat wider than the retainer.

In putting in the gear, the retainer presses the tapered ring on the tapered end of the primary shaft or that of the third speed gear. Owing to friction, the tapered ring turns through the angle corresponding to the clearance between the retainer and the tapered ring spline. The teeth of the synchronizer sleeve are thus set against those of the tapered ring (Fig. 26, b) and the gear will not be engaged until the rotation speeds of the gears to be meshed become equal. As soon as the rotation speeds of the gears are equalized, the synchronizer sleeve teeth will pass between the tapered ring teeth and get in mesh with the toothed rim of the corresponding gear (Fig. 26, c).

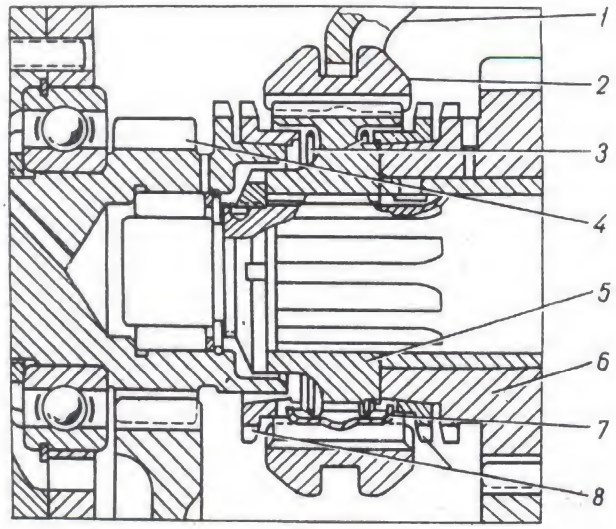

FIG. 25. SYNCHRONIZER

1 – fork; 2 – sleeve; 3 – springs; 4 – primary shaft gear; 5 – hub; 6 – third speed gear; 7 – retainer; 8 – tapered rings

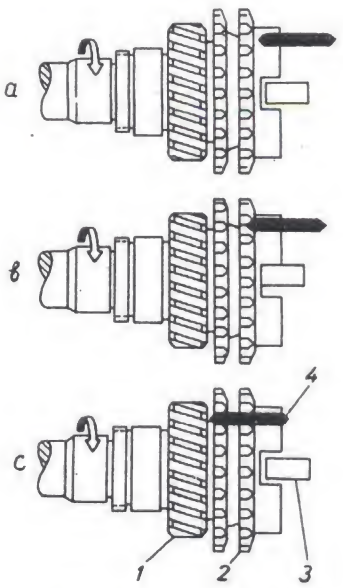

FIG. 26. SYNCHRONIZER OPERATION DIAGRAM

1 – primary shaft gear; 2 – tapered ring; 3 – retainer; 4 – synchronizer sleeve tooth

Gear-Shift Mechanism

The gear-shift mechanism is mounted in the gearbox upper cover (see Fig. 24) and consists of three selector bars with the gear-shift forks secured to the bars by locking screws. Auxiliary axle 15 installed in the upper cover slides jointly with reverse speed gear-shift fork 23.

The selector bars with shift forks are retained by locking balls 6 pressed to the selector bars by springs 7 installed in the cover bosses.

Forward speed gear selector bars have three recesses each on the upper surface, and the reverse speed gear selector bar has two recesses used for positioning the gears; engaging the gears or shifting them in the neutral position.

Arranged in the horizontal plane of the selector bars is a lock which prevents simultaneous shifting of two selector bars, (i.e. engagement of two speed gears at a time).

The lock consists of two plungers 11 located between the selector bars, and floating pin 10 placed in the horizontal bore of the middle selector bar used for shifting into the third and fourth speed gears.

Mounted in head 8 of the reverse speed gear selector bar is a safety device that prevents spontaneous engagement of the reverse speed gear.

Noise that comes from the gearbox while shifting in the gear must not be excessive.

The gear-shift mechanism linkage is interlocked by the clutch control in the first and second speed gears and in the reverse speed gear. It can operate only when the clutch is fully disengaged.

Gear-Shift Control

The gear-shift control consists of a gear-shift lever mounted in the support, two rods with universal joints, and a gear selector mechanism.

The gear-shift lever support is fastened to the bracket welded to the vehicle hull by four bolts.

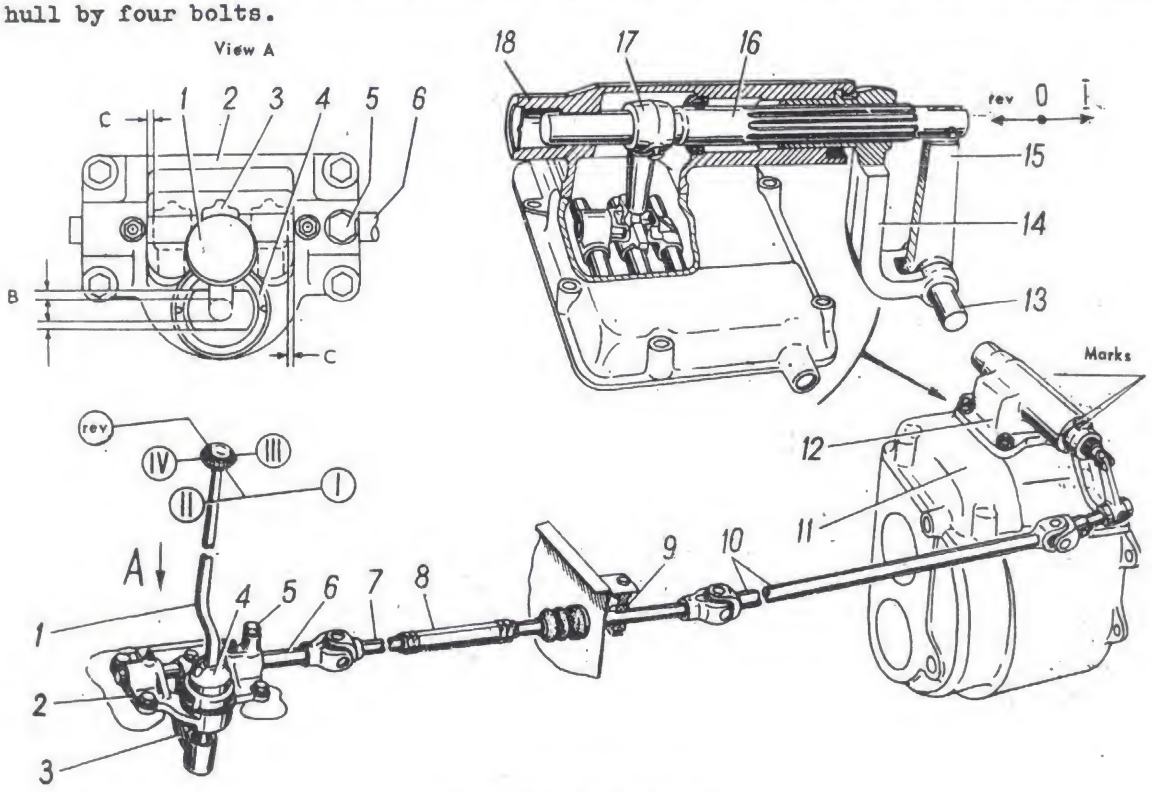

FIG. 27. GEAR-SHIFT CONTROL

1 – gear-shift lever; 2 – gear-shift lever support; 3 – shifter arm; 4 – gear-shift lever cap; 5 – gear-shift lever locking device plug; 6 – rod linkage shaft; 7 – front rod; 8 – turnbuckle barrel; 9 – intermediate bearing; 10 – rear rod; 11 – gearbox upper cover; 12 – gear-shift mechanism cover; 13 – push rod axle; 14 – rocking arm; 15 – push rod; 16 – splined shaft; 17 – selector lever; 18 – gear-shift mechanism cover housing; B – clearances between the stem of the gear-shift lever and the gear-shift lever cap; C – clearances between the shifter arm and the gear-shift lever support

Gear-shift lever 1 (Fig. 27) is located at the driver's right hand in a spherical seat made in support 2 and secured by cap 4 from above.

The lower spherical end of the gear-shift lever rests in the cylindrical seat of shifter arm 3 rigidly fixed on rod linkage shaft 6. Shaft 6 slides in gear-shift lever support 2. It has three grooves for retaining the lever in the neutral, first forward and reverse speed gear positions. Retaining is effected by a ball and a spring which thrusts against plug 5.

Front rod 7 of the gear-shift control is connected with shaft 6 through a universal joint. The front rod consists of two parts linked by turnbuckle barrel 8 used for adjustment of the control.

The rear end of the front rod rests in intermediate bearing 9 secured to the hull cross member.

Rear rod 10 of the gear-shift control is a tubular monolithic piece with two universal joints.

The gear selector mechanism is mounted on gearbox upper cover 11. It consists of housing 18, splined shaft 16 which rests on the housing and splined portion of rocking arm 14, gear selector lever 17 rigidly secured on the shaft, rocking arm 14 installed in the housing slot, and push rod 15 that shifts the splined shaft along the rocking arm during selection of the gears.

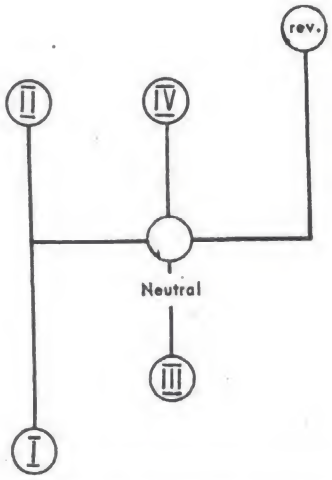

FIG. 28. GEAR-SHIFTING DIAGRAM

The gear-shift lever can be brought in five positions corresponding to speed gears (Fig. 28). Selection of the required gear is effected through rocking of the lever laterally, while engagement of the gear is effected by displacing the gear-shift lever longitudinally with respect to the vehicle axis.

To ensure smooth and noiseless shifting of gears, adhere to the following principle: when changing from a lower to higher speed gear, use the double-clutch method, and when changing from a higher to lower speed gear use the intermediate throttling method. If gear shifting is hard do not apply too much effort to the lever but rather adjust the gear-shift control and gear interlocking mechanism (see below).

Adjustment of the gear-shift control involves adjustment of the length of control front rod 7 by screwing turnbuckle barrel 8 in or off (see Fig. 27) and adjustment of the interlocking mechanism linkage by varying the length of adjustable main rod 8 (Fig. 29).

To perform the adjustment of the gear-shift control, proceed as follows:

1. Set lever 1 (see Fig. 27) in the fixed neutral position.

2. Relieve four lock nuts and rotate turnbuckle barrel 8 to adjust rocking arm 14 so that the mark on the rocking arm is aligned with the notch on gear-shift mechanism cover housing 18 (lever 1 must remain in the fixed neutral position).

3. Tilt gear-shift lever 1 in the extreme leftward position until it thrusts against cap 4, pull splined shaft 16 right off and tighten up four lock nuts of turnbuckle barrel 8.

4. Make certain that the gear-shift lever is easy to handle in selection of the gear. When the reverse speed gear is selected and the hand is taken off the lever, the lever must return to the neutral position. In this case, clearances "B" between the stem of gear-shift lever 1 and cap 4 should be roughly equal, the lever should be in the fixed neutral position and the marks on lever 14 must be aligned with the marks on cover body 18.

5. Depress the clutch pedal.

6. Check shifting in all speed gears.

With the first or the reverse speed gears engaged, clearance "C" between shifter arm 3 and gear-shift lever support 2 should be about 5 mm.

In case the interlocking shaft interferes with shifting of gears, bring the lever of shaft 2 (Fig. 29) into the lowermost position by hand and adjust the interlocking mechanism (see below).

Interlocking Mechanism

The interlocking mechanism serves to prevent spontaneous disengegement of gears. It consists of an interlocking shaft, interlocking pins and a system of rods and levers for connection with the clutch release fork.

Interlocking shaft 2 (Fig. 30) turns in the holes of bracket 1 mounted on the gearbox upper cover, and interlocking pins 3 project from the latter. A certain gap is provided between shaft 2 and interlocking pins 3.

The interlocking pins are pressed to the locking balls by the springs. The lever of interlocking shaft 2 (see Fig. 29) is connected with clutch release fork 10 by rods 3 and 8 and double-arm lever 6.

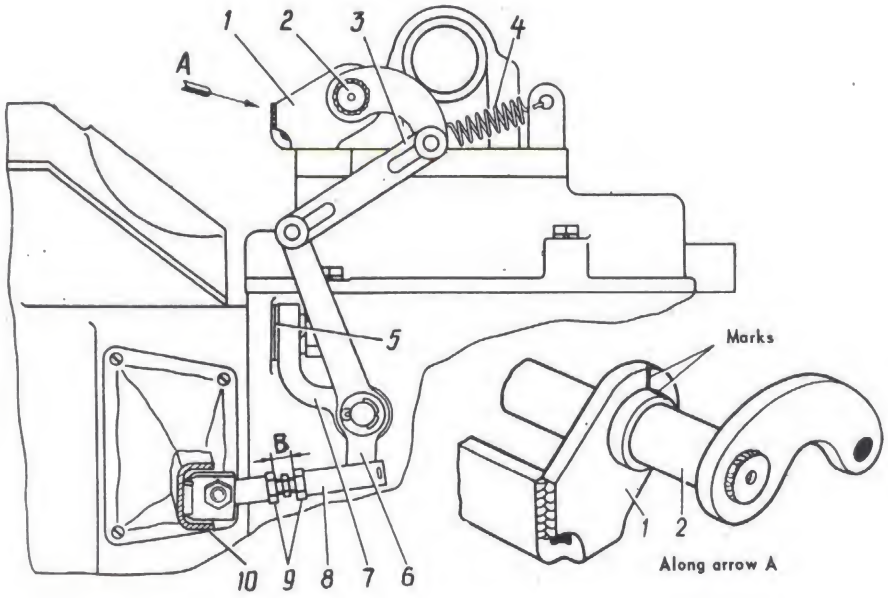

FIG. 29. GEARBOX INTERLOCKING MECHANISM

1 – shaft bracket; 2 – shaft; 3 – operating rod; 4 – spring; 5 – adjusting shims; 6 – lever; 7 – lever bracket; 8 – main rod; 9 – lock nuts; 10 – clutch release fork; B – distance between lock nuts

Depressing the clutch pedal makes the interlocking shaft turn, and its flat comes over the pins. At this moment the first, second and reverse speed gears may be engaged and disengaged. If the engagement is performed properly, interlocking takes place with the pedal release, i.e. spontaneous disengagement of the gear becomes impossible.

Adjustment of the interlocking mechanism should be carried out after the clutch control adjustment.

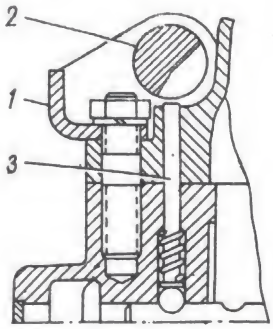

FIG. 30. SETTING OF INTERLOCKING MECHANISM SHAFT (POSITION WITH CLUTCH PEDAL DEPRESSED)

1 – shaft bracket; 2 – shaft; 3 – interlocking pin

When the clutch pedal is completely depressed, the mark on shaft 2 must align with the mark on bracket 1 or overrun it by 3 mm, maximum. This adjustment is carried out by varying the length of adjustable main rod 8. If with the shaft setting by aligning the shaft mark with the bracket mark, distance B between tightened lock nuts 9 exceeds 35 mm, remove one or two shims 5.

Upon adjustment of the interlocking mechanism, tighten lock nuts 9 as far as they will go.

Checking of the gear-shift control for proper adjustment is carried out in the following way:

1. Set the transfer low range lever in the neutral position.

2. Start the engine.

3. Depress fully the clutch pedal and engage the first speed gear to the amount of travel of gear-shift lever 1 (see Fig. 27) up to its retaining in support 2. The clearance should be between support 2 and shifter arm 3 as indicated above.

4. Release the clutch pedal. This done, despite the attempt to set the gear-shift lever in the neutral position, the lever must not get disengaged. If so, the gear-shift

control is properly adjusted. To set the lever in the neutral position, the clutch pedal must be depressed again.

5. Repeat steps 3 and 4 engaging the reverse speed gear.

Since gear-shift lever 1 has a considerably larger travel when engaging the first or the reverse speed gears as compared to other speed gears, see that the first and reverse speed gears are engaged fully and positively until the gear-shift lever gets retained. Otherwise the interlocking mechanism will fail to operate, thus causing breakage of the gear teeth in the gearbox.

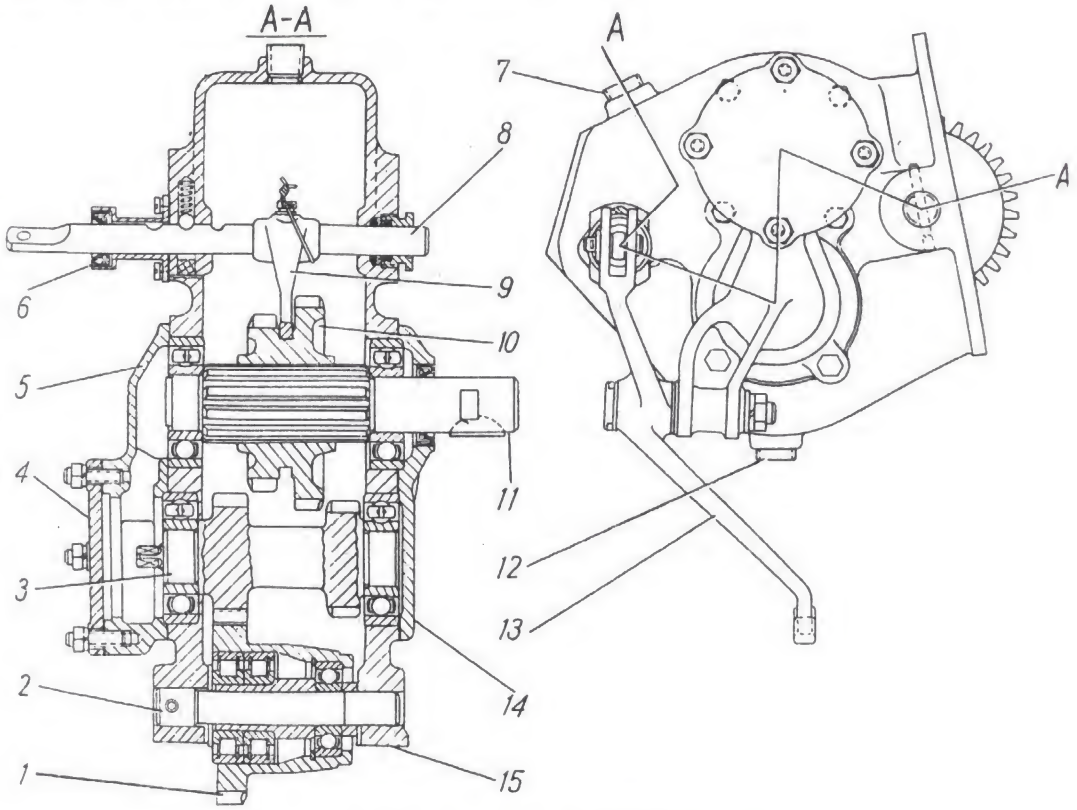

FIG. 31. WATER-JET PROPELLER POWER TAKE-OFF

1 – driving gear; 2 – axle; 3 – countershaft cluster gear; 4 – cover; 5 – front cover; 6 – oil seal; 7 – filler hole plug; 8 – rod; 9 – fork; 10 – forward and reverse speed cluster gear; 11 – secondary shaft; 12 – drain hole plug; 13 – control linkage lever; 14 – rear cover; 15 – casing

Filling of the gearbox with oil and checking of its level are performed through the hole in the water-jet propeller power take-off housing. The hole is closed by plug 7 (Fig. 31). The oil level should reach the lower edge of the hole.

Care of Gearbox

Maintenance of the gearbox includes the following operations to be performed:

1. Preventive Maintenance No. 1 includes checking of the gear-shift control and interlocking mechanism for proper adjustment and readjustment, if this is necessary.

2. Preventive Maintenance No. 2 includes the operations of Preventive Maintenance No. 1 and, in addition, checking of oil level and oil replenishment in the gearbox, if required.

3. Preventive Maintenance No. 2 performed every 6000 km of run includes:

(a) replacement of oil in the gearbox;

(b) lubrication of the bearings of the gear-shift control shaft and of the sliding surface of the interlocking mechanism linkage;

(c) checking of the gearbox for proper attachment to clutch housing;

(d) checking of the bolts securing the bearing caps of the gearbox shafts.

4. Maintenance every 15,000 km of run includes lubrication of the universal joints of rods of the gear-shift control.

WATER-JET PROPELLER POWER TAKE-OFF

The power take-off (Fig. 31) serves to transmit torque to the water-jet propeller. It is fastened to the gear case.

Driving gear 1 is constantly meshed with countershaft cluster gear 3 and transmits torque either via the countershaft cluster gear or directly to sliding gear 10 of secondary shaft 11, thus ensuring either forward or reverse rotation of the water-jet propeller screw.

Shifting of gears is effected by displacing rod 8 which is connected with the secondary shaft sliding gear through fork 9.

The power take-off rod is connected by lever 13, intermediate shaft and rod with the power take-off control lever located to the right of the driver's seat and a little behind it.

The control lever has three fixed positions:

(a) rearward position (when the water-jet propeller operates for motion forward);

(b) middle (neutral) position (when the water-jet propeller is disengaged);

(c) forward position (when the water-jet propeller operates for reverse motion of the vehicle.

Mounted on the water-jet propeller power take-off is the pump of the vehicle hydraulic system. The pump operates continuously and is driven through the coupling on the countershaft.

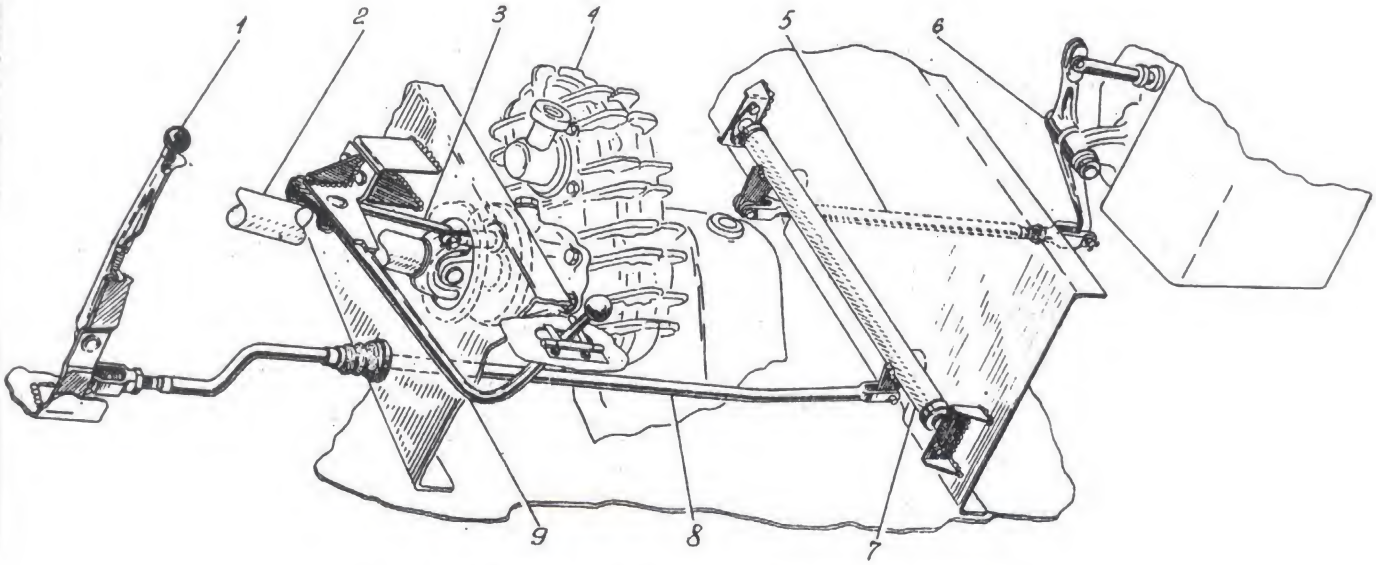

FIG. 32. WATER-JET PROPELLER AND WINCH CONTROL LINKAGE

1 – water-jet propeller control lever; 2 – winch intermediate propeller shaft; 3 – winch control rod; 4 – transfer reduction unit; 5, 8 – water-jet propeller control rods; 6 – water-jet propeller power take-off control lever; 7 – cross shaft; 9 – winch power take-off control lever

Adjustment of the water-jet propeller power take-off control linkage is performed in the following manner.

1. Latch water-jet propeller control lever 1 (Fig. 32) in the middle (neutral) position.

2. Disconnect the fork of rod 5 from double-arm lever 6.

3. Set rod 8 (see Fig. 31) in the fixed middle position which corresponds to the neutral position of the gears in the power take-off (check the fixed position of the rod by hand feel).

4. Screw the fork of rod 5 (see Fig. 32) in or off to align holes in the fork on those in the lower end of lever 6.

5. Connect rod 5 with double-arm lever 6.

6. Check operation of the control linkage. If the control linkage is properly adjusted, the latch of control lever 1 in the middle (neutral) position should contact the rear wall of the bracket ratchet slot.

Care of Water-Jet Propeller Power Take-Off

Maintenance of the water-jet propeller power take-off includes the following operations to be performed.

1. Checking of oil level, and replacement of oil. These operations are carried out in conjunction with the gearbox maintenance. To drain oil from the gearbox, screw out power take-off drain hole plug 12 (see Fig. 31).

2. Adjustment of power take-off control linkage (during Preventive Maintenance No. 2, every 6000 km of run).

3. Checking of the nuts securing the power take-off to the gearbox for tightness (during Preventive Maintenance No. 2, every 6000 km of run).

TRANSFER

The transfer case is mounted behind the gearbox and rests on two longitudinal beams and two brackets. It is fastened to the vehicle hull at four points through rubber pads. The transfer is designed to transmit torque to the front and rear axles and to the auxiliary wheels and winch power take-offs. Construction of the transfer is shown in Fig. 33.

The transfer has two ranges: high and low, the latter with a gear ratio of 1.98.

The transfer case is a cast iron casing. Installed on primary shaft 24 is rear axle or low range engagement gear 6. The primary shaft rotates in three bearings: one ball bearing installed in the front wall of the reduction gear housing and two roller bearings: one is installed in the seat of secondary shaft 7 and in the front wall of the transfer case.

Secondary shaft 7 is made integral with the gear. It rotates in two ball bearings. One is installed in the rear wall of the transfer case and the second, in secondary shaft cap 11. Mounted on the end of the secondary shaft is flange 8 used for attachment of the rear axle propeller shaft.

Countershaft 22 rotates in one ball and one roller bearings installed in the transfer case walls.

Mounted on shaft 20 driving the front axle is gear 17.

The shaft rotates in two bearings installed in the transfer case walls. Mounted on the front end of the shaft is flange 21 used for attachment of the front axle propeller shaft.

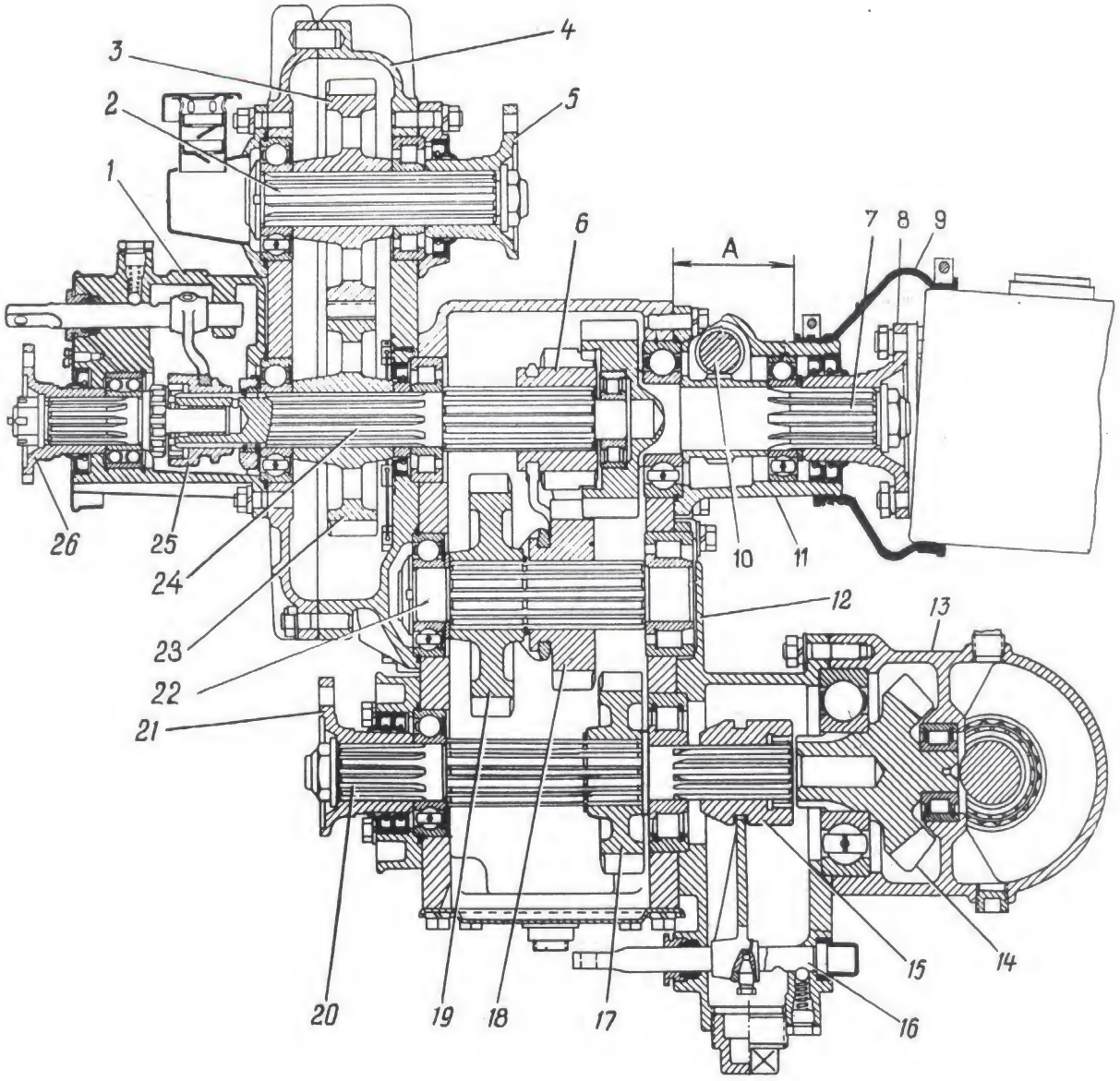

FIG. 33. TRANSFER WITH REDUCTION UNIT AND POWER TAKE-OFFS

1 – winch power take-off; 2 – driving shaft; 3 – drive gear; 4 – auxiliary reduction unit housing; 5 – intermediate propeller shaft flange; 6 – rear axle or low range engagement gear; 7 – secondary shaft; 8 – rear axle propeller shaft attachment flange; 9 – packing; 10 – speedometer drive gear; 11 – bearings cap; 12 – power take-off intermediate housing; 13 – auxiliary wheels power take-off housing; 14 – auxiliary wheels power take-off drive gear; 15 – auxiliary wheels power take-off coupling; 16 – selector bar; 17 – front axle drive gear; 18 – countershaft gear; 19 – low range gear; 20 – front axle drive shaft; 21 – flange for attachment of front axle propeller shaft; 22 – countershaft; 23 – driven gear; 24 – primary shaft; 25 – winch drive shaft coupling; 26 – flange for attachment of winch intermediate propeller shaft; A – distance from the rear end of the transfer housing to the packing is not more than 87 mm

All gears in the transfer are spur.

Shifting of gears is effected by sliding of gear 6 along the primary shaft and bringing it in mesh with the secondary shaft gear (high range gear) or gear 19 (low range gear).

The front axle is engaged by sliding of gear 18 along the splines of countershaft 22 and bringing it in mesh with gear 17.

Sliding of the gears is effected through the forks attached to the selector bars. The selector bars are connected with the front axle and range control levers through the system of rods, levers and shafts.

The retainers are arranged in the transfer case boss over the selector bars.

The transfer gear-shift mechanism is fitted with a lock that prevents transfer into the low range when the front axle is disengaged, or disengagement of the front axle when the low range gear is engaged.

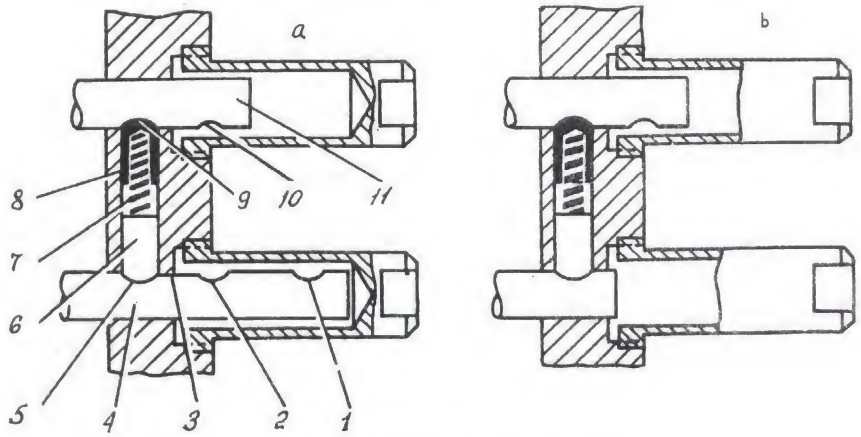

FIG. 34. TRANSFER INTERLOCKING DEVICE

1, 2, 5 – recesses on gear selector bar; 3 – flat between recesses; 4 – gear selector bar; 6, 8 – plungers; 7 – spring; 9, 10 – recesses on front axle selector bar; 11 – front axle selector bar

Construction of the transfer lock is shown in Fig. 34. Two hollow plungers 6 and 8 are installed in the transfer case opening between selector bars 4 and 11. Due to retracting spring 7, the plungers enter the recesses made in the selector bars and thus retain them in certain position.

The range selector bar has three recesses 5, 2 and 1. Middle recess 2 serves to retain the bar in the neutral position, while the two extreme recesses serve for retain the bar in the selected position. Front axle selector bar 11 has two recesses 9 and 10; the first of them serves to retain the front axle driving gear in the engaged position, and the second, in the disengaged position. Recess 9 is approximately twice as deep as recess 10.

With the selector bars arranged as shown in Fig. 34, a, the front axle and the high range gear are engaged. To engage the low range gear, selector bar 4 should be shifted leftwards until recess 1 is engaged with plunger 6 (Fig. 34, b). With the selector bar in this position (i.e. with the low range gear engaged), the clearance between lock plungers 6 and 8 will be less than recess 9. Therefore, the plunger cannot get fully out of recess 9 when selector bar 11 moves leftwards. Thus disengagement of the front axle in the low range becomes impossible. The low range gear cannot be engaged either unless the front axle is engaged.

The transfer is controlled by means of two control levers (Fig. 35). The right one is used for engagement of the front axle. It has two positions: forward (when the front axle is engaged) and rearward (when the front axle is disengaged). The

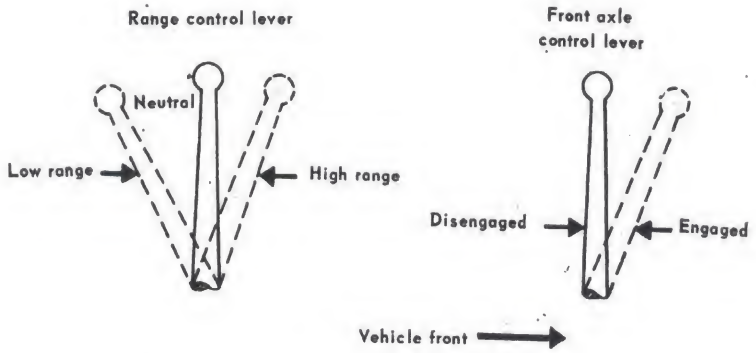

FIG. 35. POSITIONS OF TRANSFER CONTROL LEVERS

left control lever is used to shift the transfer gears. It has three positions: forward (when the high range gear is engaged), middle (neutral), and rearward (when the low-range gear is engaged).

Front axle control, range control and auxiliary wheels control linkage is shown in Fig. 36.

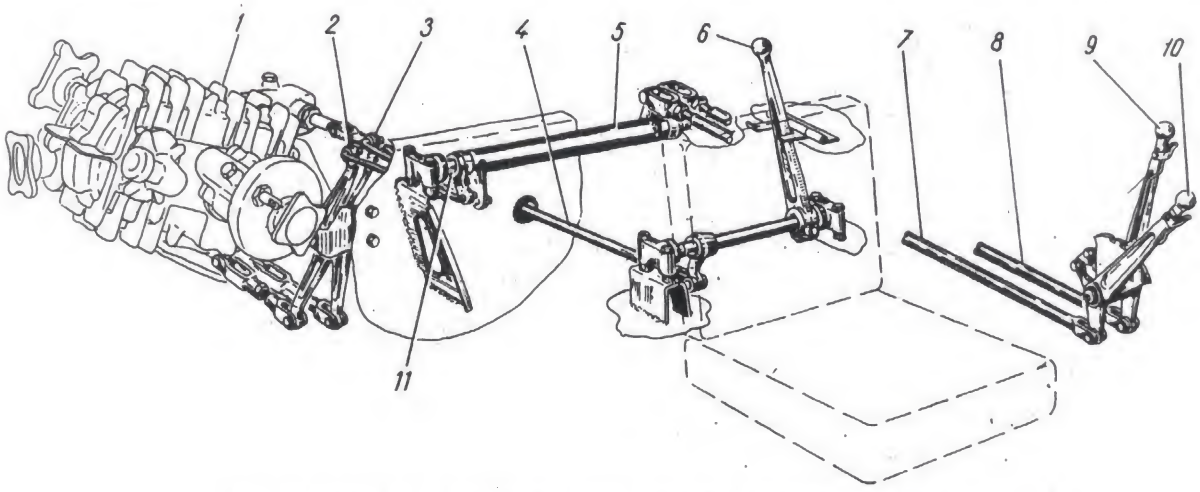

FIG. 36. FRONT AXLE, RANGE AND AUXILIARY WHEELS CONTROL LINKAGE

1 – transfer case; 2 – double-arm range control lever; 3 – double-arm front axle control lever; 4 – auxiliary wheels control rod; 5 – front axle control shaft; 6 – auxiliary wheels control lever; 7 – front axle control rod; 8 – range control rod; 9 – range control lever; 10 – front axle control lever; 11 – range control shaft

The transfer case is filled with 2 ℓ of oil through the filler hole closed with a plug. Oil is drained through the drain hole in the cover of the transfer case small hatch. Oil level is checked through the inspection hole.

Transfer Reduction Unit

Auxiliary reduction unit 4 (see Fig. 33) designed to reverse rotation of the transfer gears is fastened to the front wall of the transfer case by eight bolts.

The reduction unit housing and cover are made of aluminium alloy. Its skew gears are in constant mesh with each other. Drive gear 3 is fitted on splined shaft 2 and rotates in two bearings. Flange 5 used for attachment of the intermediate propel-

ler shaft is installed at the end of the drive gear shaft. Driven gear 23 is mounted on transfer case primary shaft 24. The interior of the reduction unit housing is separated from the transfer case by an oil seal and lubricated independently. The reduction unit housing has holes closed with plugs for filling, draining and checking oil in the housing.

Mounted on the front end of the reduction unit housing is winch power take-off 1 controlled with control lever 9 (Fig. 32). The control lever has two fixed positions: forward (when the power take-off is disengaged) and rearward (when the power take-off is engaged).

Adjustment

Linkage of the transfer control is adjusted as follows.

1. Latch front axle control lever 10 (Fig. 36) in the rearward (disengaged) position, range control lever 9 in the middle (neutral) position.

2. Disconnect the rear forks of rods 7 and 8 from levers of cross shafts 5 and 11*.

3. Disconnect the upper ends of double-arm levers 2 and 3 from the rear ends of the control link rods.

4. Make sure that the front axle selector bar is in the forward (disengaged) fixed position, and the range selector bar is in the middle (neutral) fixed position. Fixed positions of selector bars are checked by hand feel on the upper ends of double-arm levers 2 and 3.

5. Connect the upper ends of double-arm levers 2 and 3 to the rear ends of the control link rods.

6. Align fork holes on those of levers of cross shafts 5 and 11 by screwing the rear forks of rods 7 and 8 in or out. Connect the forks to the levers and tighten the lock nuts.

7. Check the control linkage for proper adjustment. The range control lever in the neutral position must play within the clearance between the control lever latch and the walls of the bracket ratchet slot. When engaging the high or low range gears, the latch must click into the bracket ratchet slots with slight tension. Front axle control lever latch must easily catch the ratchet lug when engaging the front axle.

Linkage of the auxiliary wheels and winch power take-off controls are adjusted in mush the same way as linkage of the transfer control. The purpose of adjustment is to bring into accord the positions of the control levers and that of the corresponding power take-off selector bar.

Care of Transfer

Maintenance of the transfer includes the following operations to be performed:

1. Checking of the transfer case for leakage of oil (during Daily Maintenance), and trouble-shooting, if any.

2. Checking of oil level in the transfer case, reduction unit and auxiliary wheels power take-off housing, and replenishment in case of necessity (during Preventive Maintenance No. 2). Replacement of oil every 6000 km of run.

3. Checking and adjustment, whenever necessary, the transfer control linkage (during Preventive Maintenance No. 2, every 6000 km).

* Front axle control shaft 5 is a tube which houses range control shaft 11.

4. Checking of the bolts fastening the bearing caps of transfer shafts for tightness (during Preventive Maintenance No. 2, every 6000 km).

AUXILIARY WHEELS POWER TAKE-OFF

The power take-off is used to transmit torque to the right-side and left-side auxiliary wheels. It is mounted on the rear wall of the transfer case.

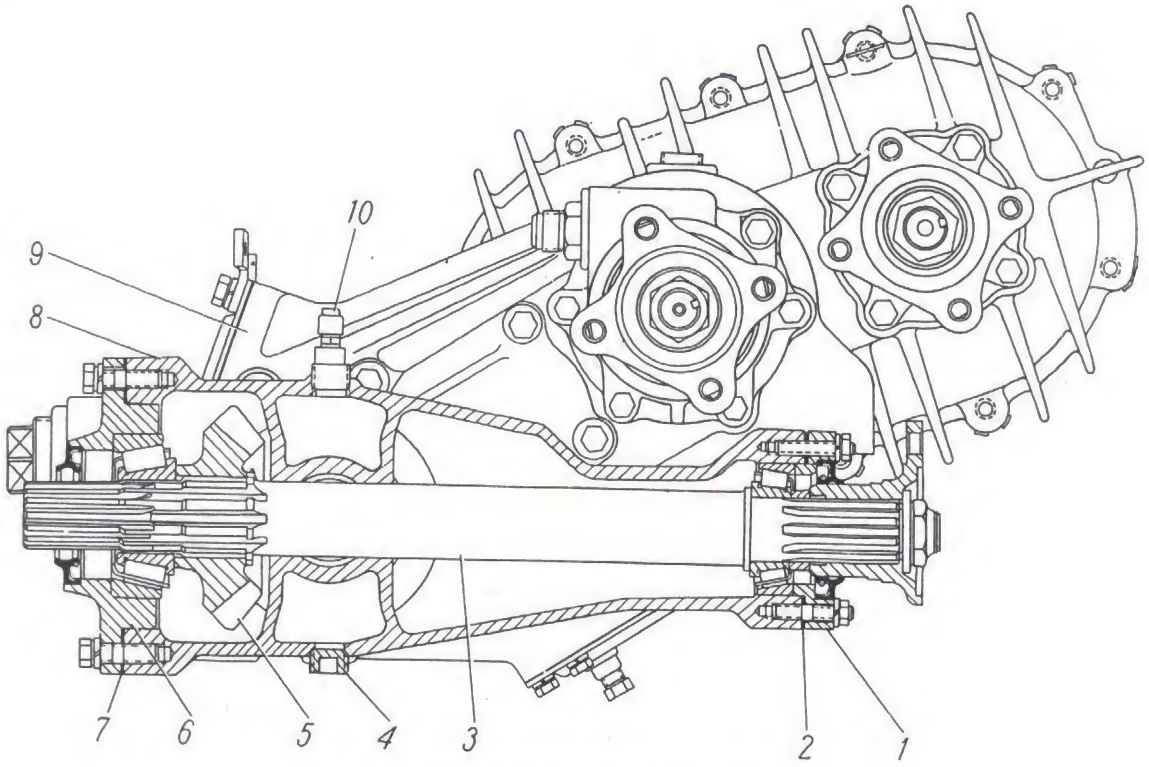

FIG. 37. AUXILIARY WHEELS POWER TAKE-OFF

1 – smaller cap; 2 – adjusting shims; 3 – driven shaft; 4 – drain plug; 5 – driven gear; 6 – larger cap ; 7 – adjusting shims; 8 – power take-off housing; 9 – transfer case; 10 – breather

The power take-off incorporates the following main parts: housing 12 (see Fig. 33), housing 13, gears, shaft, bearings and gear-shift mechanism. Drive gear 14 is installed in one ball and one roller bearings. Driven gear 5 (Fig. 37) is mounted on power take-off driven shaft 3. The shaft rests in tapered bearings. Secured to the right end of shaft 3 is a flange for coupling with the right-side propeller shaft of the auxiliary wheels drive. Installed on the left end of the splined shaft is the slip yoke of the left-side propeller shaft of the auxiliary wheels drive. Fitted in caps 1 and 6 are spring-loaded rubber oil seals.

Preloading of tapered bearings is adjusted by means of shims 2 placed under smaller cap 1. The shims are made 0.1, 0.25 and 0.5 mm thick.

The bearings should be adjusted so that the shaft has no palpable axial play but is free to rotate. This play can be checked by hand feel of the shaft flange when the auxiliary wheels drive propeller shafts are disconnected.

Meshing of the bevel gear pair is adjusted by means of shims 7 placed under the housing larger cap 6. The tapered bearings and meshing of the bevel gear pair are adjusted at the Manufacturing plant and require no additional adjustment by the using arms personnel.

The power take-off is controlled with control lever 6 (Fig. 36) which has two positions: forward (when the auxiliary wheels drive is engaged), and rearward (when the auxiliary wheels drive is disengaged).

The power take-off is engaged by sliding of coupling 15 (see Fig. 33) along splines of shaft 20. Inner teeth of coupling 15 get in mesh with outer teeth of the shank of drive gear 14.

The power take-off may be engaged when the vehicle is both at halt and in motion. It must be engaged only after all the auxiliary wheels are lowered into the working position. Never engage the power take-off and lower the auxiliary wheels simultaneously.

The power take-off should be engaged only for negotiating of obstacles (trenches and pits). In other situation when the vehicle is in motion, the power take-off must be disengaged.

The power take-off housing should be filled with oil at the time of filling the transfer case. Oil level is checked through the inspection hole. Oil is drained through the drain holes made in the transfer case and in the auxiliary wheels power take-off housing.

PROPELLER SHAFTS

The purpose of the vehicle propeller shafts is to transmit torque from the gearbox via the transfer to the driving axles and auxiliary wheels drive, as well as from the gearbox via the power take-off to the water-jet propeller and from the transfer to the winch.

The vehicle has the following eight propeller shafts used for connection of the vehicle assemblies:

1. Intermediate propeller shaft 5 (see Fig. 20) - gearbox to transfer reduction gear.
2. Propeller shaft 18 - transfer to front axle.
3. Propeller shaft 13 - transfer to rear axle.
4. Propeller shafts 6 and 14 - power take-off to right- and left-side auxiliary wheels drive.
5. Propeller shaft 9 - water-jet propeller power take-off to water-jet propeller.
6. Propeller shafts 3 and 20 - transfer to winch.

The rear, front and intermediate propeller shafts as well as the auxiliary wheels drive propeller shafts are provided with hermetic universal joints, and the water-jet and winch drive propeller shafts employ non-hermetic universal joints.

The hermetic universal joints have neither lubrication fittings nor safety valves. Screwed into the central hole of universal-joint centre cross 6 (Fig. 38) is stopper 3. Sealing ring 7 which protects the interior of the bearings from dirt and leakage of lubricant is installed in the seat of the bearing race.

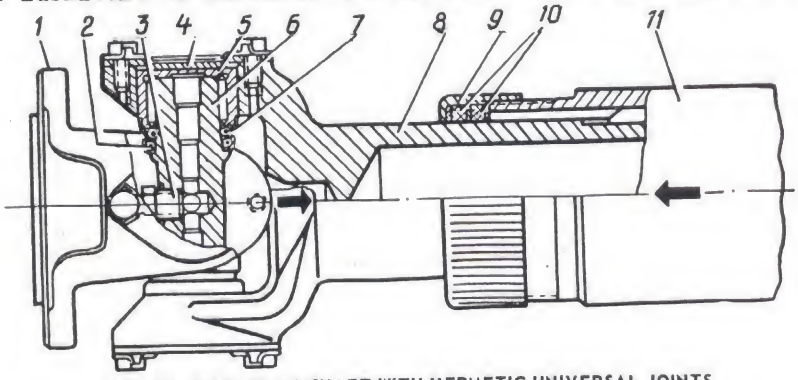

FIG. 38. PROPELLER SHAFT WITH HERMETIC UNIVERSAL JOINTS

1 – flange; 2 – cork sealing; 3 – stopper; 4 – bearing cap; 5 – bearing; 6 – centre cross; 7 – sealing ring; 8 – slip yoke; 9 – oil seal shell; 10 – oil seal; 11 – shaft

Care of Propeller Shafts

Maintenance of the propeller shafts includes the following operations to be performed:

1. Checking of the bolts and nuts that fasten the propeller shaft flanges for tightness. Particular attention should be paid to reliable fastening of the intermediate propeller shaft flange to the gearbox flange.

First tightening-up of all the bolts and nuts that fasten the propeller shaft flanges must be carried out after the first 1000 km of vehicle run. Further, the tightening-up of the bolts and nuts fastening the flanges of the intermediate propeller shaft is checked during Preventive Maintenance No. 1, and that of all the other propeller shafts, during Preventive Maintenance No. 2.

Upon tightening up the bolts fastening the flange of the propeller shaft driving the rear axle, it is necessary to secure rubber sealing 9 (see Fig. 33) on cap 11 of the transfer secondary shaft bearings. The front end face of sealing 9 should be at a distance not exceeding 87 mm from the rear end face of the transfer case (in Fig. 33 this size is designated by letter A).

After tightening up the bolts fastening the propeller shaft driving the front axle, it is necessary to install the rubber sealing so that it bears up against the end face of the transfer case.

2. Replacement of lubricant in splined connections of the front and rear propeller shafts (during Preventive Maintenance No. 2, every 6000 km of run).

3. Replacement of lubricant in the splined connection of the intermediate propeller shaft (after 15,000 km).

4. Lubrication of universal joints of the propeller shaft of the water-jet propeller (after 50 hours of operation on water). To replace lubricant in the propeller shaft splined connections, remove slip yokes, remove old and apply fresh lubricant. When reinstalling the slip yokes, see that the arrow on the yoke align with that on the shaft. Oil seal retainers should be tightly secured.

5. Lubrication of universal joints of the winch propeller shafts (after 15,000 km).

6. Replacement of lubricant in universal joints of the rear, front and intermediate propeller shafts and the auxiliary wheels propeller shafts (after 15,000 km of run or 5 years of vehicle operation).

To ensure complete filling of the universal joints with lubricant and prevent looseness of the bearing races, replacement of lubricant is to be carried out as follows.

1. Remove the propeller shafts with hermetic universal joints from the vehicle.
2. Bend off the lock plates, remove the bolts and tap against flange 1 (see Fig. 38) and yoke 8 with a copper hammer to drive bearings 5 off tenons of centre cross 6; then screw out stopper 3, wash bearings and centre cross oil passages in kerosene and dry them.
3. Check visually the universal joint parts for condition and replace them, if worn.
4. Fill all four bearings to 1/3 of their volume with lubricant, type No. 158.
5. Lubricate the tenons of centre cross 6 and rubber sealing rings 7.
6. Assemble the universal joint, for which purpose place centre cross 6 into holes of yoke 8 and flange 1, install bearings 5 one after another and lock them with caps 4.
7. Make sure the oil passages in the centre cross are filled with lubricant which must come off the central hole.
8. Reinstall and screw-in tightly stopper 3, remove excess of lubricant from the surface of the centre cross, and lock the bearing cap bolts.

WARNING. Screwing-in of the stopper before installation of all the bearings leads to slipping of the race off the bearing.

9. Install propeller shafts in the vehicle taking care to align the arrows on the slip yokes and shafts.

Note. If lubricant No. 158 is not available, fill the universal joints will oil MT-16n upon washing the centre crosses and bearings. In this case operations under Items 4 through 8 must be performed as follows:

4. Give stopper 3 one or 1.5 turns forward and leave it so for a while. This is necessary for bleeding of air and excess of lubricant through thread in the course of assembly.
5. Fill three bearings to half their volume with oil MT-16n. As to the fourth one to be installed the last, lubricate only its inner side and needles. Lubricate the tenons of centre cross 6 and rubber sealing rings 7.
6. Assemble the universal joint. For this purpose, bring the tenons of centre cross 6 into the holes of yoke 8, install the bearing from below and secure it with the cap. Install flange 1 on the two side tenons, then, tilting the centre cross tenons downwards and simultaneously putting the bearings on the tenons, install the two side bearings in turn and secure them with caps. See that all centre cross channels are full of lubricant. This can be checked on how the upper (fourth) tenon channel is filled with lubricant.
7. Install the fourth bearing with lubricated interior from above and secure it with cap 4.
8. Drive in stopper 3 right home and lock the bearing cap bolts.

FRONT AND REAR AXLE ASSEMBLIES

The front axle assembly transmits traction power to the front steerable wheels by means of the axle drive, differential, and steering knuckles with constant-velocity universal joints.

The axle drive and differential are similar in the front and rear axle assemblies. The axle drive is hypoid.

The front axle housing and rear axle housing, rectangular in section, are made of two forged halves welded along the horizontal axis.

The design of the front axle steering knuckle is shown in Fig. 39. Secured to the axle shaft housing with studs is spherical bearing 20. Mounted on the king pins of the spherical bearing is steering knuckle body 16 connected to journal 22.

The wheel hub is mounted on the journal on two tapered bearings. Mounted on the splined portion of the journal is the brake, and the recess in the outer end of the journal houses the seal unit for the tyre pressure control system.

The steering knuckles are provided with two steering stop bolts. One of the bolts is welded to the shock-absorber bracket and limits the turning angle of the inner wheel (relative to the centre of turn) to 25°, and the other is screwed in the lug in the steering knuckle body and locked by a nut. The Manufacturer's adjustment ensures limiting of the turning angle of the inner wheel (relative to the centre of turn). Hereby, the bolt screwed into the knuckle lug on the outer wheel must be 4 to 6 mm away from the spherical bearing neck.

Constant-velocity universal joint 21 (see Fig. 39) is provided with two knuckles: one inner (driving) and one outer (driven). Torque is transmitted from the driving knuckle to the driven one through four driving balls. The middle ball is installed on the pin and serves for centering of the knuckle. Longitudinal displacement of the constant-velocity universal joint is limited by thrust washers 19, one of which is installed in the spherical bearing and the other, in the journal.

To extract constant-velocity universal joint 21 from steering knuckle body 16, proceed as follows:

1. Remove the wheel (see Chapter 5, Section "Wheels and Tyres").
2. Disconnect the inflation system and brake fluid hoses from journal 22.
3. Remove driving flange 5 complete with cap 6.
4. Unscrew twelve nuts and remove journal 22 jointly with hub 25 and brake drum 11 without disassembling them. This done, extract the constant-velocity universal joint.

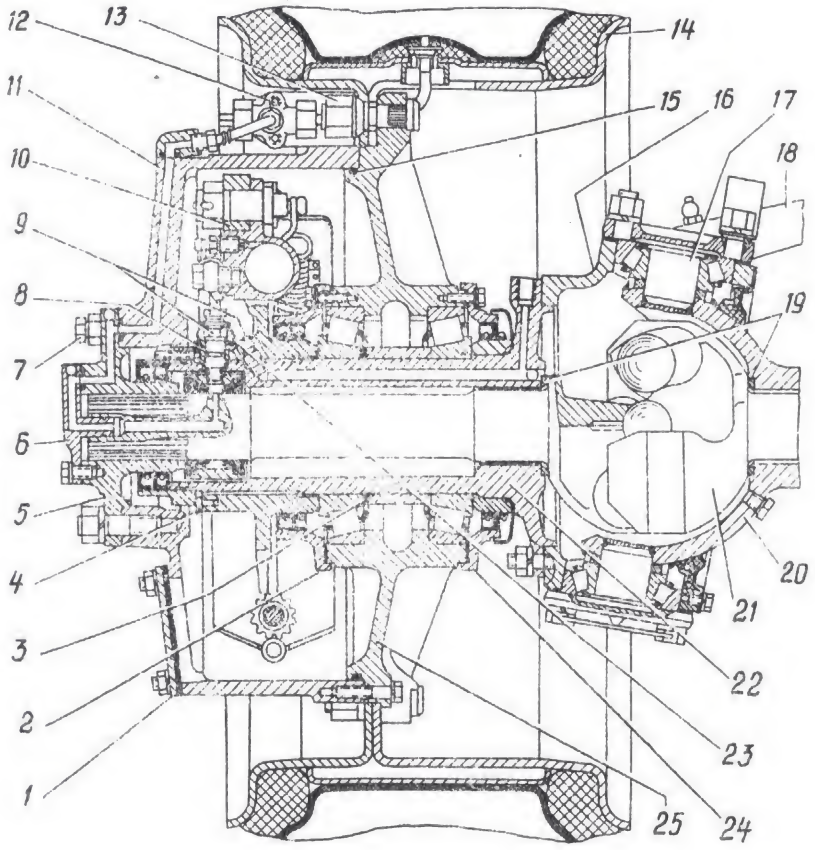

FIG. 39. FRONT WHEEL (SECTIONAL VIEW)

1 – access hatch cover; 2 – bearing outer cap; 3 – adjusting shims; 4 – lock washer; 5 – driving flange; 6 – flange cap; 7 – puller bolt; 8 – adapter pipe union; 9 – air delivery nipples; 10 – brake; 11 – drum; 12 – air cock; 13 – wheel nut; 14 – wheel disk; 15 – sealing ring; 16 – steering knuckle body; 17 – king pin; 18 – steering lever; 19 – thrust washers; 20 – spherical bearing; 21 – constant-velocity universal joint; 22 – journal; 23 – protecting sleeve; 24 – inner cap; 25 – hub

CAUTION. In reinstalling the journal jointly with the hub and brake, thoroughly centre the journal relative to the outer knuckle of constant-velocity universal joint 21. Avoid sharp displacing of the journal and skewness of the tyre pressure control system seal unit at the moment it gets onto the splined end of the universal joint knuckle.

It is not advisable to disassemble the constant-velocity universal joint unless urgent need arises. But if this is the case, disassemble the constant-velocity universal joint in the following way:

1. Mark mutual arrangement of the universal joint knuckles with paint or chalk.

2. Set the joint vertically so that the driven (outer) knuckle faces upwards to allow the pin to slip down by gravity in the bore of the central ball.

If the pin fails to slip down, strike the inner knuckle end face lightly against a wooden block or separate the knuckles and lower the pin with a screwdriver, turn the central ball jointly with the pin and remove the latter.

3. Turn the central ball so that its flat faces one of the driving balls and tilt down the driving knuckle. Now one of the driving balls can be removed from the universal joint. After the first ball is extracted, it is easy to remove the others.

To reassemble the universal joint, proceed as follows:

1. Secure the driving knuckle in the vice (with knuckle facing upwards).

2. Place the central ball into the recess in the driving knuckle so that the ball flat is facing sidewards.

3. Mount the driven knuckle over the central ball.

4. Turning the driven knuckle sidewards, install the three driving balls into the knuckle grooves one after another.

5. Bring apart the knuckles to a maximum angle and turn the central ball so that its flat faces the groove of the fourth driving ball. Set this ball into the groove so that it bypasses the flat.

6. Separate the knuckles, insert the pin into the bore of the central ball and turn the ball so that the central ball pin is aligned on the bore in the driven knuckle. This done, unite the knuckles.

Adjustment of Steering Knuckle King Pin Bearing Tightening

Checking of the king pin bearing for tightening should be performed every 6000 km of run with the wheels jacked up and the steering rods removed, In checking, it is necessary to swing manually the wheels in several positions in the vertical plane within the turning angle of the wheel on the king pins. In case of palpable wheel play on the king pins, adjust the bearings. Eliminate the play otherwise it may result in premature destruction of the bearings.

To adjust the bearing, proceed as follows:

1. Extract the constant-velocity universal joint (see above).

2. Remove the spherical bearing oil seal.

3. Screw out the bolts securing the king pin bearing upper and lower caps, remove the caps, then remove two shims of the same thickness: one from above and one from below.

Reinstall the caps, tighten the bolts and check the bearings for play. If the play persists, remove one shim from each cap again until the play is eliminated.

When the bearings are properly adjusted, each knuckle must turn when a slight hand effort is applied.

If the dynamometer is being evenly pulled, the effort applied to the steering lever of the steering tie rod at the place of the spherical pin, with the spherical bearing oil seals removed and the constant-velocity universal joint extracted, should be 2 to 4 kgf.

The upper king pin bearings should be lubricated during Preventive Maintenance No. 2.

Adjustment of Wheel Hub Bearings

Adjustment of tightening of the wheel hub bearings is particularly important. Axial play of the bearings is checked by swinging the wheel. Excessive play results in knocks in the bearings when the vehicle is in motion and, consequently, in destruction of the bearings. Excessive tightening causes overheating of the bearings and may also result in their failure.

During Preventive Maintenance No. 2, every 6000 km of run, check the wheel hub bearing for tightness and re-adjust, if necessary.

Adjustment of the wheel hub bearings is performed with shims 3 (Fig. 39) placed between the outer bearing inner race and distance bushing.

To adjust the wheel hub bearing, proceed as follows:

1. Set the vehicle on metal or wooden props in such a way that the tyres are clear off the ground.

2. Screw out the wheel nuts and the two bolts fastening the pipe union on the brake drum. Remove the wheel.

3. Unscrew fourteen bolts securing the drum to the wheel hub and remove the drum jointly with the driving flange or the axle shaft (of the rear axle).

4. Pull out the cotter pin, and screw out the lock screw and the bearing nut. Remove lock washer 4.

5. Slacken the nuts on the air and brake fluid delivery pipes, screw out air delivery line nipples 9, adapter pipe union 8 and the brake fluid delivery pipe union*.

6. Remove the bracket with the brake shoes from the splines.

7. Unscrew the bolts of bearings outer cap 2 and remove the cap.

8. Remove the sealing ring placed between the brake shoe bracket and the outer bearing inner race.

9. Extract the outer bearing inner race and remove as many shims 3 as required.

The bearings must be tightened so that the hub resistance to rotation, with the bearing inner races tightened and the cap and oil seals (on the brake side) removed, is 0.7 to 1.1 kgf·m. This corresponds to an effort of 3.5 to 5.5 kgf applied to the wheel bolts.

10. Upon completing the adjustment of the bearing for tightening, assemble the wheel hub in the reverse order.

Before reassembly, coat threaded portion of the bearing nuts and air delivery line nipples with sealing paste СК ОЦБ or nitro-glyptal enamel. The wheel hub bearing nut must be tightened up to the stop and locked in position by a lock screw and a cotter pin inserted into the screw head hole.

WARNING: If there is a need to remove the hub from the journal, screw out the bolts fastening the inner cap and disconnect the cap from the hub prior to removing the hub, otherwise the inner bearing and the oil seal will be damaged.

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* For procedure of screwing out the air delivery line nipples and the adapter pipe union, refer to Page 106.

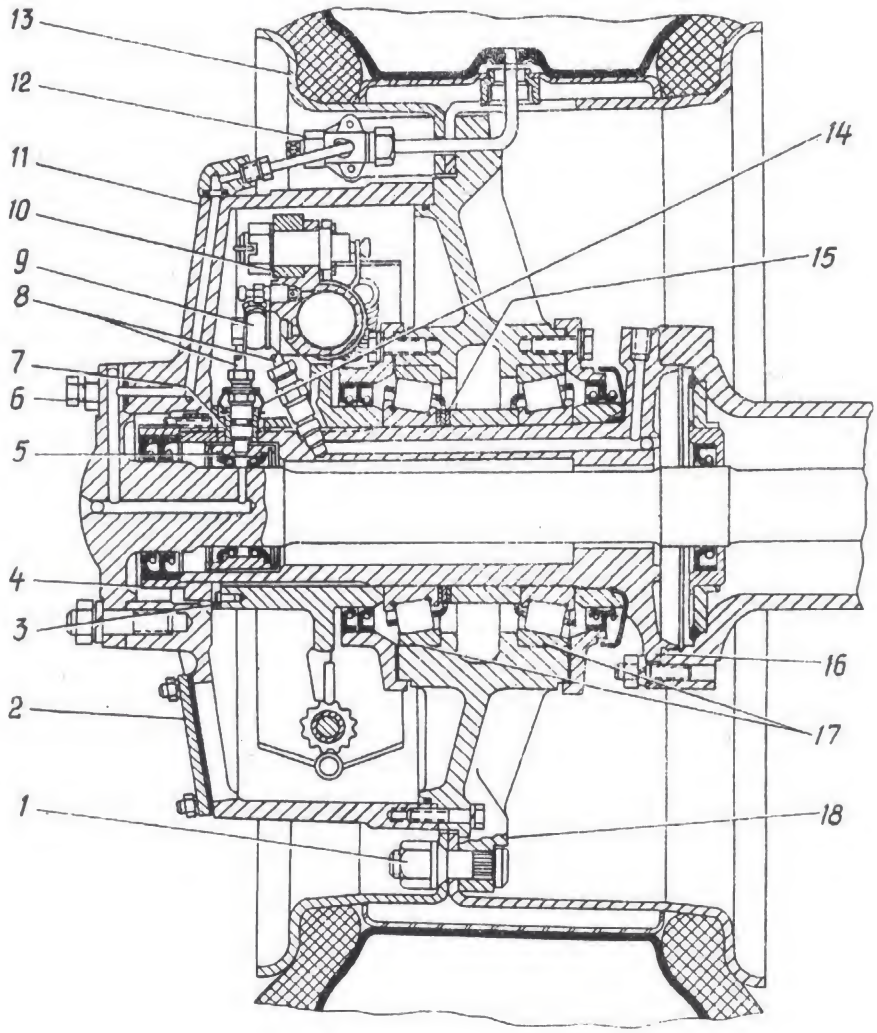

FIG. 40. REAR WHEEL (SECTIONAL VIEW)
1 – wheel nut; 2 – hatch cover; 3 – lock washer; 4 – bearing nut; 5 – seal unit; 6 – puller bolt; 7 – adapter pipe union; 8 – connecting pipes; 9 – coupling sleeve; 10 – brake; 11 – drum; 12 – air cock; 13 – wheel; 14 – protecting cap; 15 – adjusting shims; 16 – journal; 17 – bearings; 18 – hub

Adjustment of front and rear wheel hub bearings is made in the same manner.

Finally check the bearings for adjustment by monitoring the hub heating in the moving vehicle. Check immediately after stopping the vehicle, on the inner side of the wheel. Slight heating of the hub is not harmful, but if the hub is heated much, add several shims between the outer bearing inner race and distance bushing.

Care of the front and rear axle assemblies, besides the adjustments above, involves checking of tightening of the axle shaft nuts (on the rear axle) and of attachment of the steering knuckle lever and spherical bearings to the axle shaft housings (on the front axle). Initially these operations are carried out after the first 1000 km of run. Further on, the steering knuckle lever is checked for attach-

ment during Preventive Maintenance No. 2, and the axle shafts and spherical bearings, every 6000 km of run.

Renewal of lubricant in the wheel hub bearings is carried out after 15,000 km of run or when repairing the axles.

To renew lubricant in the wheel hub bearings, proceed as follows:

1. Perform steps 1 through 8 set forth in Section "Adjustment of Wheel Hub Bearings" (see above).

2. Remove the bolts securing inner cap 24 (see Fig. 39), detach cap 24 and remove hub 25 from axle journal 22.

3. Extract bearing inner races, remove old lubricant, wash the bearings and hub interior.

4. Fill the hub interior and bearings with 0.42 kg of fresh lubricant ЦИАТИМ-201.

5. Assemble in the reverse order and perform step 9 (see page 75) to adjust the bearings.

To ensure watertightness of the axles, all gaskets and shims and threaded portions of bolts screwed into through holes should be coated with a thin film of lubricant AMC-3 or other water-resistant lubricant in the course of assembly performed in service.

AXLE DRIVE

The front and rear axle drives are similar in design save for the hand of threading on axle drive pinion oil ring 12 (Fig. 41). In the front axle, threading is RH, and in the rear axle it is LH. To distinguish the rings, the front axle oil ring bears mark "П" (front) on the end face of the ring.

Axle drive pinion 9 is mounted in two tapered roller bearings 6 and 16 and one cylindrical roller bearing 18.

Preloading of the axle drive pinion tapered bearings is effected by selection of adjusting ring 15 placed between the inner races of the tapered bearings. The height of the adjusting ring is 12.1 to 12.94 mm; the size step is 0.04 mm.

Axle drive gear 26 is fastened to the flanges of separator 28 and the differential carrier by bolts with castle nuts. The separator and differential carrier 22 rotate in bearings 29 installed in the seats provided in the axle drive housing and closed by caps 24.

Boring of the seats in the axle drive housing and in differential bearing caps 24 is carried out in assembly, therefore, after disassembly the caps should be placed in their initial places and in the initial position. Preloading of the axle drive gear bearings is effected through nuts 20. The same nuts are used to adjust the position of the axle drive gear, i.e. the backlash and the area and position of the gear-contact pattern in meshing of the gears.

Adjusting screw 4 of the stop permits keeping a constant clearance of 0.25 mm between the face of axle drive gear 26 and the stop bushing. This extends the service life of the axle drive.

The differential is a cam-type one fitted with twenty four radial slide blocks 25 staggered in the holes of the separator in two lines.

The differential outer sprocket has six cams equally spaced over the circumference, and its inner sprocket has two lines of staggered cams (six cams in each line).

The axle drive and differential are installed in casing 19. The latter is mounted in the opening of the axle housing and fastened by bolts 31.

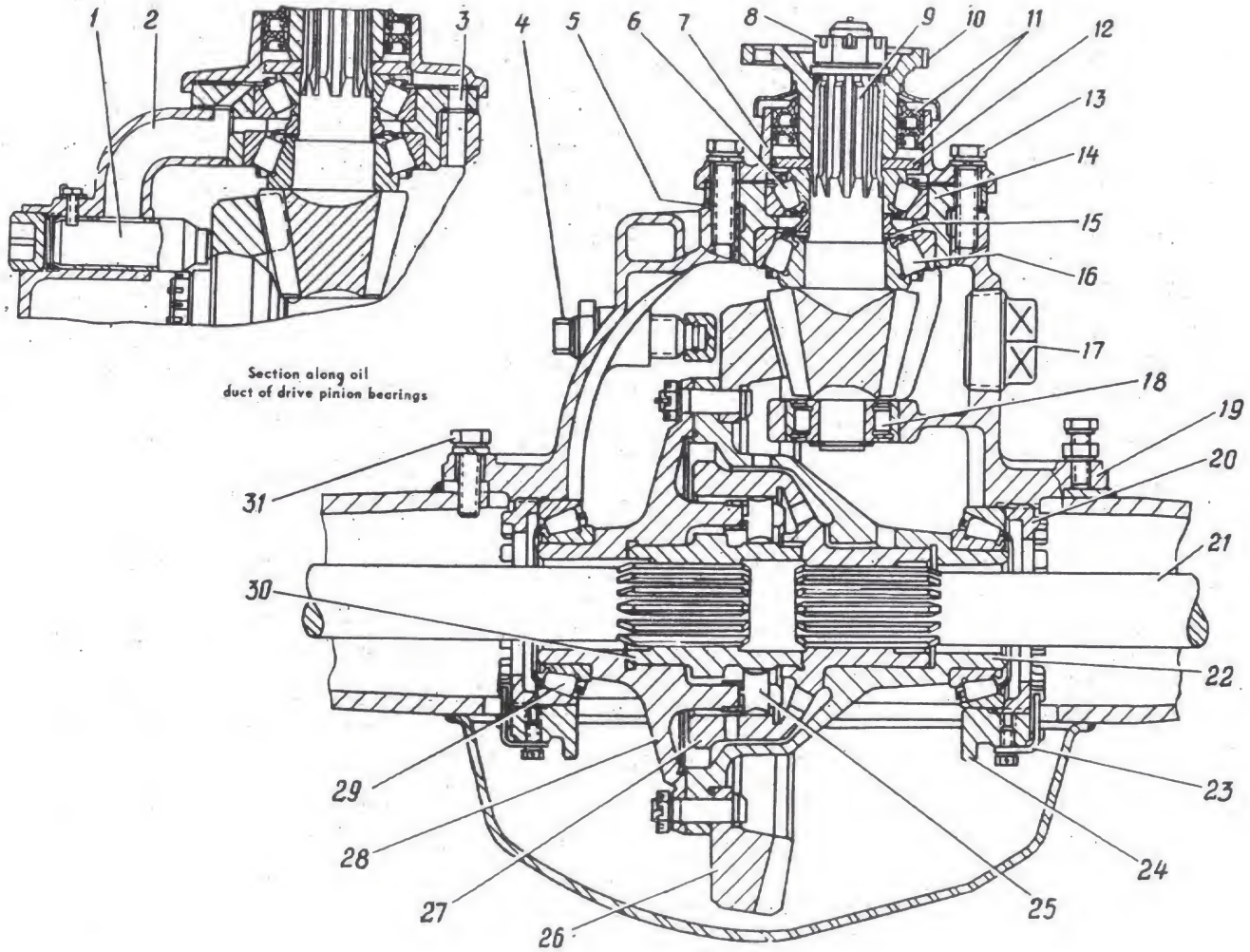

FIG. 41. AXLE DRIVE

1 – bushing; 2 – upper oil duct; 3 – lower oil duct; 4 – stop adjusting screw; 5 – shims; 6, 16, 29 – tapered bearings; 7 – cover; 8 – nut; 9 – drive pinion; 10 – flange; 11 – oil seals; 12 – oil ring; 13, 31 – bolts; 14 – coupling; 15 – adjusting ring; 17 – plug; 18 – roller bearing; 19 – casing; 20 – nut; 21 – axle shaft; 22 – differential carrier; 23 – locking plate; 24 – cap; 25 – slide block; 26 – axle drive gear; 27 – outer sprocket; 28 – separator; 30 – inner sprocket

To ensure forced lubrication of the drive pinion bearing in the front or rear axle assembly, a two-way oil supply pipe is installed in the reduction gear housing. Contacting the axle drive gear face, this pipe collects oil entrained by the gear and directs it to the bearings via upper oil duct 2 and bores in coupling 14. Oil is drained through lower oil duct 3. To prevent excessive pressure inside the case when it is heated up during operation, the axle housing incorporates a breather hose connected to the vehicle hull.

Adjustment of Driving Axles

The bearings of the axle drive pinion and axle drive gear, gear backlash and gear-contact pattern are adjusted at the manufacturing plant and, as a rule, do not require any adjustment when in service. Only in case of replacement of parts or heavy wear of the bearings, adjustment is necessary.

Large backlash of the axle drive teeth resulted from wear of the teeth must not be taken up by adjustment since it will disturb the mutual arrangement of the run-in surfaces and, as a result, noise or breakage of the teeth.

Changing of position of adjusting screw 4 of the stop in service is not advisable. Adjust only in case the nut is loose. For this purpose, drive in adjusting screw 4 of the stop right home, then give it 1/6 of turn back and lock it with lock a nut.

Take up play in the tapered bearings but do not disturb the mutual arrangement of the axle drive pinion and axle drive gear.

Adjustment procedure for the driving axles is given below.

A d j u s t m e n t o f A x l e D r i v e P i n i o n
B e a r i n g s t i g h t e n i n g

If axial play of the drive pinion exceeds 0.03 mm, tighten up the bearings by mounting adjusting ring 15 of a smaller size. Check the axial play with an indicating device by displacing the axle drive pinion from one extreme position to the other. If the device is not available, swing the flange manually to check the bearings for necessiry of tightening adjustment. If the axle drive pinion sways in the tapered bearings, adjust the bearings by all means.

To carry out the adjustment, proceed as follows:

1. Disconnect the propeller shaft.
2. Remove axle shafts (for the front axle, steering knuckle universal joints).
3. Remove the reduction gear housing bolts (twelve pieces).
4. Remove the reduction gear by making use of two puller bolts.
5. Screw out axle drive gear stop adjusting screw 4 so that the end face of the bushing does not project over the reduction gear housing boss end face.
6. Remove oil supply pipe.
7. Unlock and unscrew the differential bearing nuts.

Prior to unscrewing the nuts, mark their position relative to the bearing caps (make marks on the nuts and on the caps).

8. Remove the differential bearing caps.
9. Shift the differential towards the axle drive gear stop and remove the differential.
10. Screw out bolts 13 that fasten coupling 14.
11. Remove the axle drive pinion jointly with the coupling and flange 10.
12. Unscrew nut 8, remove flange 10, oil seal cover, oil ring 12, outer bearing inner race with rollers, and adjusting ring 15.

13. Select the required adjusting ring, assemble the coupling in the vice using the reverse procedure but without the oil seal and cover 7; then tighten nut 8 as far as it will go. While tightening nut 8, rotate flange 10 to evenly distribute bearing rollers in both races.

Upon adjustment, tighten nut 8 as far as it will go. Never turn it even slightly back to align its slot with the cotter pin hole. Insufficient tightening of the nut results in slippage of the bearing inner race, wear of adjusting ring 15 and, consequently, hazardous axial play of the axle drive pinion.

Check this nut for proper tightening after 15,000 km of run.

14. Check tightening of the bearings. Interference of the bearings should be so adjusted that resistance to the drive pinion rotation is 10 to 18 kgf·cm (without the oil seals). To check the bearings for tightening, use a dynamometer (Fig. 42).

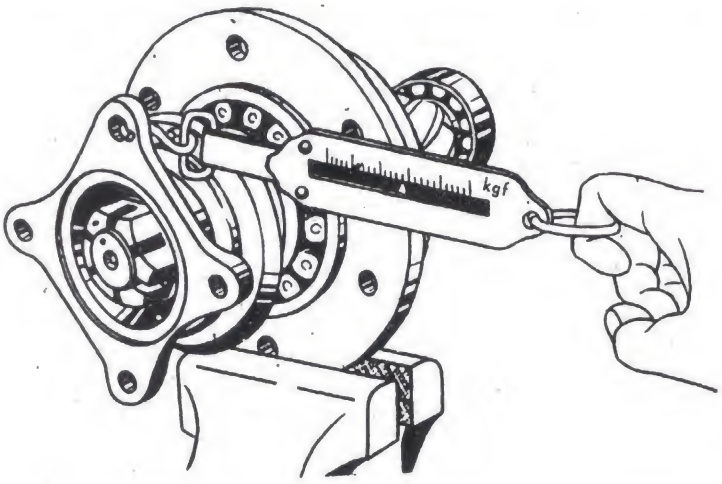

FIG. 42. CHECKING OF AXLE DRIVE PINION BEARINGS FOR TIGHTENING

For this purpose, fasten the coupling in the vice, hook one of the flange holes with the dynamometer and smoothly rotate the pinion. The dynamometer scale should read 2 to 3.7 kgf (which corresponds to a torque of 10 to 18 kgf·cm). If rotational resistance of the bearing proves to be within the normal range, mark position of the nut relative to the shank end face (make marks on the shaft end face and on the nut).

15. Unscrew the nut, place the oil seal with the cover home, tighten the nut to the marked position and forelock it.

16. Reinstall the coupling.

Assemble the reduction gear. In doing so, see that differential bearing nuts are tightened to the marked positions.

Reinstall the reduction gear and connect the flanges of the propeller shaft and axle drive pinion.

To adjust preloading of the differential bearings, make use of nuts 20 (see Fig. 41). To obtain the required preloading value (0.12 to 0.25 mm), tighten the adjusting nut until the play in the bearings is completely eliminated, then turn on the nut by one more slot.

In case the tab of locking plate 23 does not align with the slot, tighten the nut towards increase of preloading.

To set stop adjusting screw 4 correctly, drive the screw in up to the stop, then give it 1/6 of a turn back and lock it with the nut.

Adjustment of Meshing of Axle Drive Pinion and Axle Drive Gear

When a new axle drive pinion or drive gear is installed, set them in correct mutual position ensuring the required contact of their teeth. Otherwise, the gears will produce abnormal noise and their service life will be short.

Note. Prior to adjustment of positions of the axle drive pinion and drive gear, adjust preloading of the bearings as described above.

The position of the axle drive pinion is adjusted by selecting shims 5 (see Fig. 41) of the required thickness placed under the bearing sleeve flange.

The position of the axle drive gear is varied due to the adjusting nuts. To keep preloading in the differential bearings unchanged, axial displacement of both the nuts must be perfectly the same. For example, if there is a need to back out the LH nut to a certain degree screw in the RH nut to the same degree, and vice versa. Check meshing of the axle drive pinion and axle drive gear on the gear-contact pattern and backlash.

To perform the gear-contact checking, coat the axle drive gear teeth with a thin film of paint, and turn the axle drive pinion in either direction. The gear-contact pattern should be as shown in Fig. 43. If the gear-contact pattern does not comply with the required one, change the position of the axle drive pinion or the axle drive gear. Change in the position of the gears will cause the change in backlash which should be kept, however, within 0.15 to 0.3 mm.

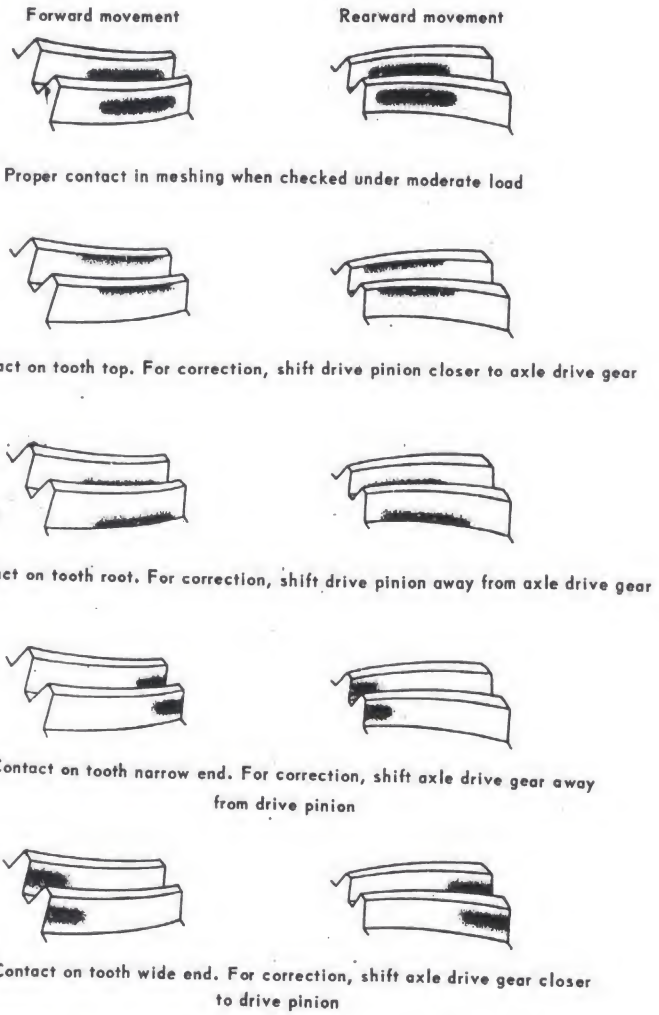

FIG. 43. AXLE DRIVE GEAR-CONTACT PATTERN

The value of backlash is measured with an indicating device on the displacement of an axle drive gear tooth.

Care of Axle Drive

In addition to the adjustments described above, care of the axle drive includes checking of the axle drive reduction gears for proper attachment to the axle housings. This operation (and tightening of the bolts, if required) is carried out after the first 1000 km of run.

Checking of the level of oil in the axle drive housings and its replenishment are carried out during Preventive Maintenance No. 2.

Oil is renewed every 6000 km of run.

TRANSMISSION TROUBLES AND REMEDIES

Symptom and cause	Remedy
Clutch slips:	
(a) oil gets on friction facings from engine or gear box, or as a result of excessive lubrication of clutch release bearing;	Eliminate oil leakage. Replace driven disk or friction facings. If friction facings are slightly greasy, wash them with gasoline and clean operating surfaces with fine-grained emery cloth
(b) friction facings worn to rivets;	Replace driven disk assembly or friction facings
(c) loose or broken clutch pressure springs	Replace pressure springs
Incomplete release of the clutch (clutch drags):	
(a) air in clutch hydraulic system;	Bleed air from clutch hydraulic system
(b) deformed driven disk	Replace driven disk (runout of disk facings should not exceed 0.7 mm)
Abnormal noise in clutch release bearing: lack of grease in bearing	Lubricate or replace bearing
Spontaneous disengagement of gears in gearbox or transfer case:	
(a) maladjusted interlocking mechanism;	Adjust interlocking mechanism
(b) loose springs or broken synchronizers of 3rd and 4th speed gears;	Replace weak springs or other defective parts of synchronizers
(c) excessively worn gear teeth	Replace worn gears
Hard gear engagement:	
(a) maladjusted gearbox or transfer control;	Adjust control
(b) maladjusted gearbox interlocking mechanism	Adjust interlocking mechanism
Abnormal noise in gearbox or transfer case: excessively worn (broken) gear teeth or shaft bearings	Replace defective gears or shaft bearings
Propeller shafts knock:	
(a) loose attachment of universal joint flanges;	Tighten flange nuts
(b) worn universal joints;	Replace worn universal joints
(c) worn movable parts of splined joints	Replace propeller shaft having worn splines

Chapter 4

STEERING SYSTEM AND BRAKE SYSTEMS

STEERING SYSTEM

When moving on land, the vehicle is steered by turning the front axle wheels.

Steering of the vehicle on water is performed by simultaneously turning the front axle wheels and the rudders mounted on the supports installed in the hull water-jet bay. The upper ends of the rudder shafts are fitted with levers 14 and 17 (Fig. 44) connected with steering arm 2 through a system of rods. Turning of the steering wheel results in simultaneous turning of the front wheels and the rudder blades.

The steering system includes the steering gear, steering control linkage, and steering booster for the control linkage.

Steering Gear

The steering gear consists of a steering handwheel, steering shaft, steering column, worm gear, steering arm shaft, and case with caps and bearings. The steering gear case is fastened to the bracket secured to the vehicle hull bottom plate. The steering column is secured to the instrument panel by means of a U-shaped bolt.

The steering gear transmission incorporates hourglass worm 13 (Fig. 45) and steering arm shaft tripple-flange roller 4, constantly meshed with the worm. The worm and the roller are made of alloy steel and hardened to a high degree of wear resistance.

The steering gear worm is pressed onto the splines of hollow steering shaft 10. The steering handwheel hub is fitted on the splines of the upper tapered end of the steering shaft and secured in place with a nut. The worm is placed in cast iron case 6 in two roller bearings 1 and 14. Inner working surfaces of the bearings are in fact, the worm surfaces.

The outer race of upper bearing 14 is pressed into case 6. To provide for adjustment of the bearings, the outer race of lower bearing 1 is slide-fitted in the case. The bearings are closed by the caps bolted to the case. Placed between lower cap 2 and case 6 are shims 3 for adjustment of the worm bearings. The shims are of two sizes: 0.17 mm and 0.1 mm thick.

Roller 4 constantly meshed with worm 13 is installed on axle 9 in the groove of the steering arm shaft head and rotates in two ball bearings.

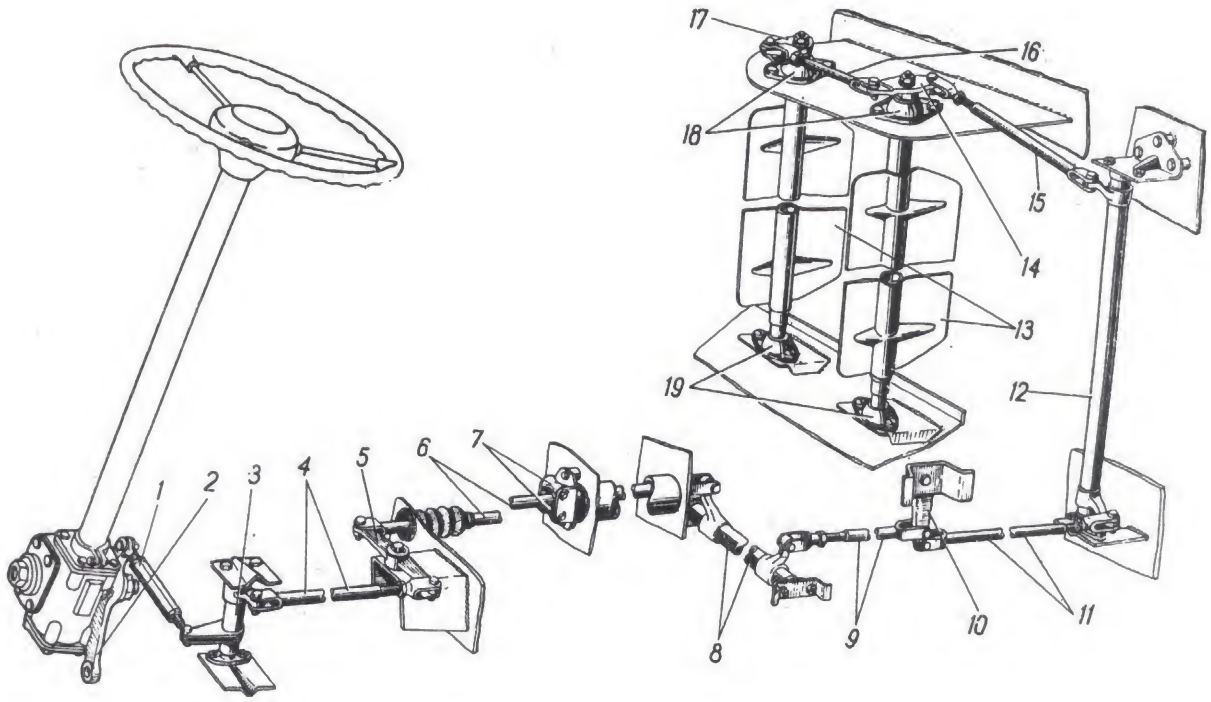

FIG. 44 . RUDDER STEERING CONTROL LINKAGE

1 – rod; 2 – steering arm; 3 – front shaft; 4 – front rod; 5 – double-arm lever; 6 – middle rod; 7 – rod rollers; 8 – cross shaft; 9 – link rod; 10 – rocker lever; 11 – rear rod; 12 – rear shaft; 13 – rudder blades; 14, 17 – rudder control levers; 15 – rear shaft rod; 16 – coupling rod; 18 – upper spherical bearings; 19 – lower spherical bearings

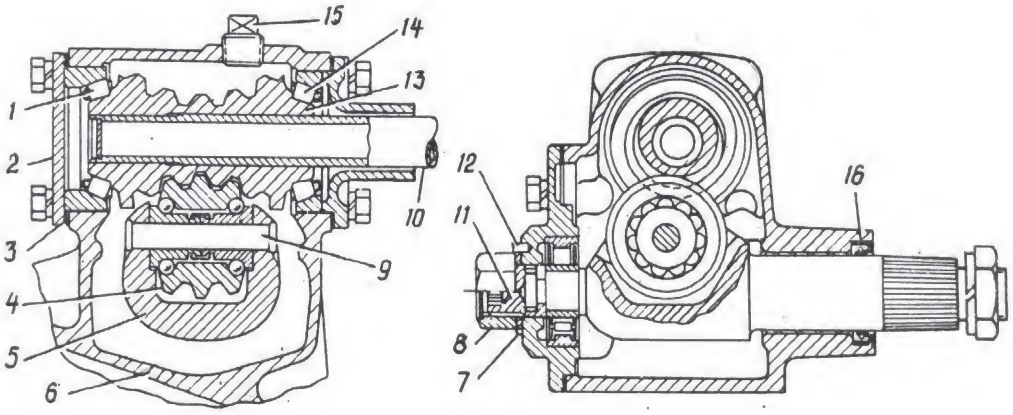

FIG. 45. STEERING GEAR

1 – lower bearing; 2 – lower cap; 3 – adjusting shims; 4 – double-flange roller; 5 – steering arm shaft; 6 – case; 7 – lock washer; 8 – nut; 9 – roller axle; 10 – steering shaft; 11 – adjusting screw; 12 – locking pin; 13 – worm; 14 – upper bearing; 15 – plug; 16 – oil seal

Through the port in the case wall, steering arm shaft 5 is mounted in the case, complete with the side cover which is bolted to the case. A gasket of paronite is placed under the side cover. Spring-loaded oil seal 16 is fitted on the shaft where is protrudes from the case.

The shaft rests in two bearings: a cylindrical roller bearing mounted in the side cover and a sliding bearing which is actually a bronze bushing pressed into the steering gear case.

Screwed in the case side cover is adjusting screw 11. When installing the cover in place, the steering arm shaft cylindrical tail piece tightly fits in the adjusting screw groove. The adjusting screw is held against revolution by special lock washer 7 pressed to the side cover by cap nut 8. A sealing gasket is placed under the lock washer.

Proper engagement of the roller with the worm is adjusted by turning adjusting screw 11 with the wrench for the transfer case plugs. The adjustment is made possible due to the fact that the steering gear roller axis is deflected (by approximately 6 mm) relative to the plane passing through the worm axis and perpendicular to the steering arm shaft axis. With the roller so positioned, it is possible to bring it closer to the worm by turning the adjusting screw in, thus reducing the meshing clearance which tends to increase when worm and gear get worn out.

To drain oil from the steering gear, give the bolts securing lower cap 2 (Fig. 45) 3 or 4 full turns back, shift the lower cap jointly with the shims downward and completely drain oil to a vessel. When oil stops dripping, thoroughly tighten the lower cap bolts.

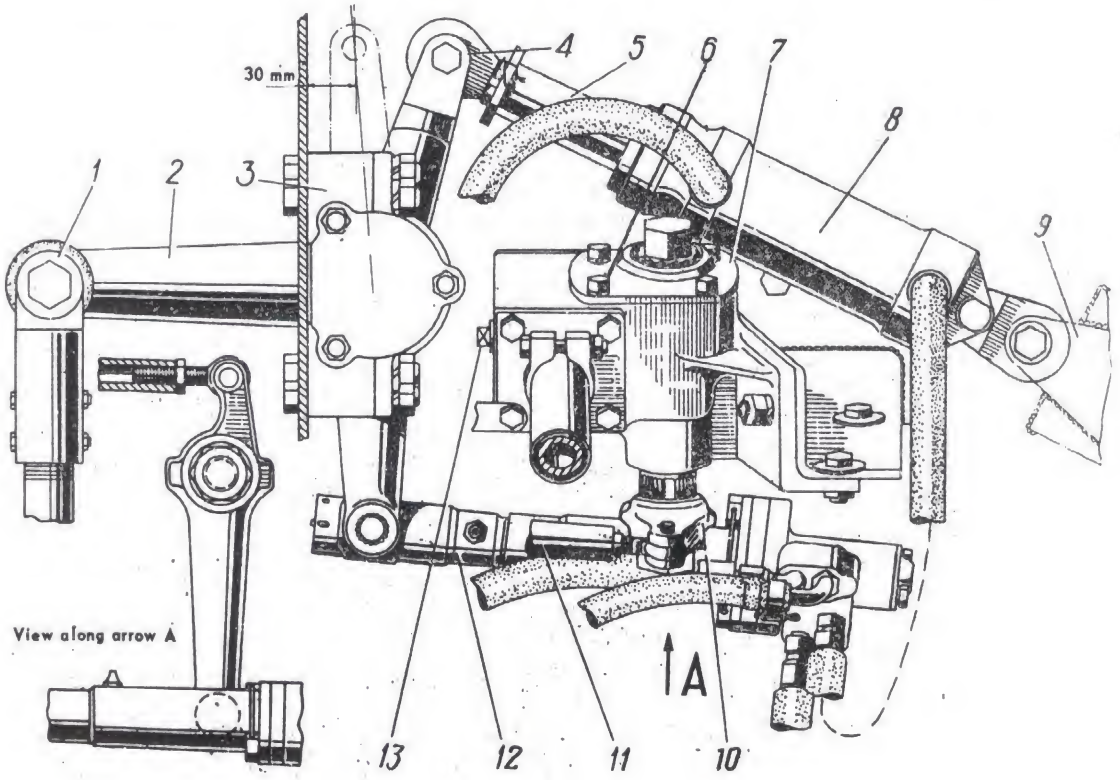

FIG. 46. STEERING CONTROL LINKAGE

1 – steering drag rod; 2 – pendulum; 3 – pendulum bracket; 4 – double-arm lever; 5 – piston rod; 6 – bolt for oil lever check hole; 7 – steering gear; 8 – power cylinder; 9 – power cylinder bracket; 10 – steering arm; 11 – rudder control rod; 12 – steering arm rod; 13 – filler plug

To replace oil in the steering gear case, perform the following two steps:*

(a) use the grease gun to pour oil through the oil filler hole closed by plug 13 (Fig. 46) up to the plug level, and then screw in the plug;

(b) screw out upper bolt 6 of the steering gear case side cover and add oil through the opening; for pouring oil, insert a 6-mm pipe, 100 to 150 mm long, into the grease gun nozzle and fix it with insulating tape.

When oil reaches the hole level, screw in side cover bolt 6, remove the vessel containing drained oil and remove oil remains from the vehicle hull.

Steering Control Linkage

Steering control linkage of vehicle БРДМ-2 incorporates steering arm 10 (Fig.46), steering arm rod 12, pendulum bracket 3, double-arm lever 4, pendulum 2, steering drag rod 1, a tie rod and levers on the steering knuckle body. Steering arm rod 12 and steering drag rod 1 are coupled with steering arm 10 and the levers by means of inserted pins. Spherical heads of the pins at the ends of steering drag rod 1 are pressed to the slide blocks by springs. The springs automatically take up the clearances resulted from wear of the parts and cushion impact loads exerted on the steering gear parts. The stops limit compression of the springs and prevent breakage resultant of severe bumps experienced by the front wheels.

To lubricate the ball-head pins, both ends of the rods are fitted with lubrication fittings. The ball-head pins are provided with protective sleeves to protect the hinged joints from dirt and to prevent leakage of lubricant.

The force applied to steering arm rod 12 is transmitted to steering drag rod 1 via double-arm lever 4, pendulum bracket 3 and pendulum 2.

Pendulum bracket 3 is a housing fastened to the hull by six bolts. A shaft rotates inside the housing in two bearings. Shallow V-shaped splines are cut on the shaft tapered end. Fitted on the lower end of the shaft is double-arm lever 4, and pendulum 2 is welded to the shaft upper end.

To facilitate proper setting of the levers, the shaft splines have four evenly spaced twin recesses which correspond to the respective projections on the levers.

Interior of pendulum bracket 3 is filled with lubricant during assembly. Spring-loaded oil seals installed on both sides of the bracket keep the inner space clear of dirt, prevent outflow of the lubricant and penetration of water into the hull during operation on water.

Motion is transmitted from the LH steering journal to the RH one through the tie rod, whose ends are fitted with screwed-on tips secured by bolts. The RH and LH tips are provided with different thread pitch to allow more accurate adjustment of toe-in. The tips are provided with lubrication fittings for lubrication of pins. Rubber sealing rings with metal straps keep the rod tips clear of dirt and hold lubricant.

The steering arm is fitted on shallow V-splines made on the tapered end of the steering arm shaft and secured by a nut with the spring washer.

For correct setting of the steering arm relative to the shaft, the steering arm has four evenly spaced twin splines and the shaft has corresponding recesses.

If properly installed, the steering arm is tilted about 5° from the vertical (with its lower end towards the longitudinal axis of the vehicle). Prior to installation of

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* For replenishment, one step is performed (pouring of oil through the opening of the side cover upper bolt).

the steering arm, make sure that the steering arm shaft is in the neutral position. To bring the steering arm shaft from the neutral position to either of the extreme ones, give the steering handwheel approximately two and a half full turns.

Steering Booster

The steering booster is designed to decrease the effort which must be applied to the steering handwheel to turn the steerable wheels, to reduce the shock loads exerted on the steering gear and to step-up driving safety by making it possible to control the direction of movement even when one of the steerable wheel tyres is blown.

The steering booster consists of the valve (see Fig. 47), power cylinder, oil pump, oil filter, safety valve, tank, and oil lines (pipes and hoses).

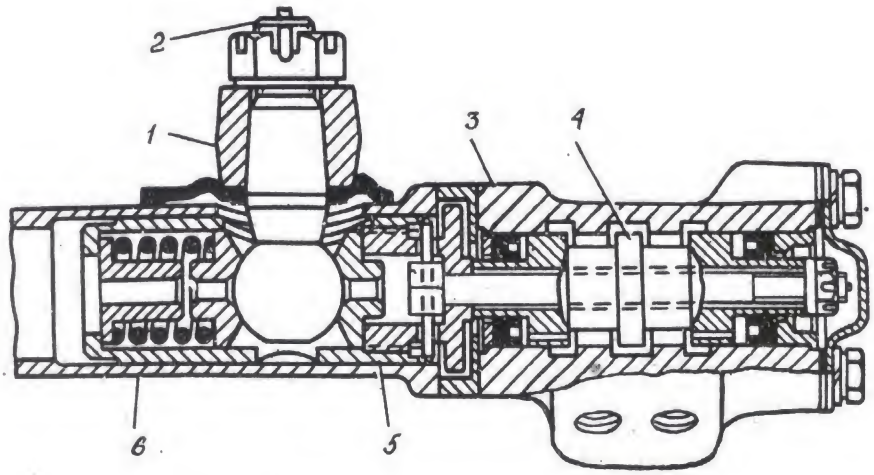


FIG. 47. STEERING BOOSTER VALVE

1 – steering arm; 2 – pin; 3 – housing; 4 – slide valve; 5 – sleeve; 6 – rod

The oil pump, oil filter, safety valve, tank and some oil pipes are common for the steering booster and the auxiliary wheels hydraulic system.

Steering booster power cylinder 8 (Fig. 46) is mounted in the hull front. It is hinge-jointed with bracket 9 welded to the hull and is connected to double-arm lever 4 by means of piston rod 5. Extreme leftward turn of the vehicle is effected when the cylinder piston thrusts against the rear cap of the cylinder, and extreme rightward turn, when the cylinder piston thrusts against the cylinder head.

Improper coupling of the cylinder piston rod end with the double-arm lever will disturb the symmetry of turning of the wheels to the right and to the left, and result in a larger turning radius to the right or to the left.

To ensure correct coupling of double-arm lever 4 to the end of piston rod 5, pull the rod out up to the stop, set the lever at the centre of the hole 30 mm from the side wall, then turn the rod end in or out to align the hole in the lever with that in the rod end, insert the bolt, and fasten it in position. Lock the rod against revolution by means of retainers inserted into the grooves of the piston rod and rod end.

The steering booster control valve is connected with the steering arm rod.

The valve incorporates housing 3 (Fig. 47) and slide valve 4 coupled with sleeve 5 by a coupling bolt and a nut. The slide valve housing has four pipe unions: for fluid delivery, return, and supply to the front and rear cavities of the cylinder.

When the vehicle runs straight ahead, the slide valve occupies the middle position relative to its housing and the fluid supplied by the pump via passages in the housing and the slide valve goes in the return line towards the tank thus by-passing the power cylinder cavities.

When the driver starts turning the steering handwheel, the slide valve changes its position relative to its housing and cuts off (breaks) the flow of fluid passing through the valve into the return line.

Now the fluid supplied by the pump is directed via the housing passages to one of the power cylinder cavities, and at the same time the other cavity of the cylinder becomes communicated with the slide valve return channel.

The fluid flow is cut off only when the driver turns the steering handwheel. As soon as the driver stops turning the handwheel, the slide valve returns in the middle position and the fluid is again directed to the return line. To bring the vehicle to the straight-ahead motion, it is necessary to turn the steering handwheel to the initial position. In this case, the slide valve moves in the opposite direction, and the above-mentioned operating cycle of the steering booster repeats itself.

When dismounting the hydraulic system or stopping leakage, it is necessary to bleed air accumulated in the system. To do this, open the tank cap, add the fluid to the required level, start the engine, and turn the steering handwheel alternately in both directions until foaming of the fluid ceases.

If the level of fluid drops significantly after several turns, it means that there is leakage in the hydraulic system; the leakage must be detected and eliminated. Should foaming of the fluid persist for a long period, make sure there is no inleakage of air into the hydraulic system through seals or joints. Eliminate causes of air inleakage, if any.

Adjustment of Steering System

Adjusted in the steering system are the steering gear (worm bearings and meshing of the steering worm and roller) and toe-in. The necessity of adjustment is judged by free play of steering handwheel with the steerable wheels in the straight-ahead position. With the engine inoperative, the play of the steering handwheel, when turned to the right (left) up to a soft stop by driving the steering handwheel arm with a finger, must not exceed 35° for new vehicles and 38° for vehicles that ran much. These angles are equal to the distance of 130 mm or 141 mm, respectively, between the extreme points on the steering handwheel rim. With the engine operative, the handwheel play in a new vehicle is practically zero.

With the engine inoperative, the play of the steering handwheel depends on the slide valve travel in the steering arm rod (for a new vehicle) or on the slide valve travel in the steering arm rod and clearances in the worm bearings and in the worm-and-roller gear resulted from long operation (for the vehicles which ran much).

The necessity of adjustment may be judged more exactly by evaluating play at the steering arm end without any axial play of the worm shaft.

Before checking the steering handwheel play, it is necessary to check tightening of the steering gear case bolts, tightening of the steering gear bracket bolts, and tightening of the steering arm nut. Tighten up the bolts and nut, if required.

The hinge joints of the steering linkage are non-adjustable. If the hinge joints are properly serviced (regularly lubricated) and the protective hoods and plates are

not damaged, the hinge joints are practically wearless. Play in the hinge joints of the steering linkage must be determined by turning the steering handwheel with the engine inoperative until the steerable wheels start to move. Absence of knocks and relative displacement of the hinge-jointed parts is indicative of zero play in the hinge joints of the steering linkage.

Adjustment of Worm Bearings

The steering worm bearings get worn out only after a long period of service.

Prior to adjustment, check the steering worm bearings for axial play. For this done, proceed as follows:

(a) disconnect rods from the steering arm;

(b) swing the steering arm by hand. If the worm shaft has some axial displacement felt on the steering handwheel, the worm bearings must be adjusted.

To adjust the worm bearings, proceed as follows:

1. Remove the steering gear from the vehicle.
2. Drain oil and remove the steering arm shaft with the side cover.
3. Detach the steering gear case lower cover and remove the thin shim.
4. Reinstall the steering gear case lower cover and check the steering worm bearing for axial play. If the play is not eliminated, remove the thick shim and place back the thin one.
5. Upon taking up the play, check the steering handwheel rim for the steering effort. It must not exceed 0.5 kgf for new vehicles and 0.3 kgf for vehicles that ran much (with the steering arm shaft removed).
6. Assemble the steering gear and pour 0.67 *l* of oil into the case.
7. Install the steering gear in the vehicle.
8. Reinstall the steering arm and connect rods to it. The wheels must be parallel to the vehicle axis and the steering gear roller must be in the middle position relative to the worm.

Adjustment of Steering Worm and Gear

Because of running-in and wear of the steering worm and gear during operation, periodically check backlash of the worm and gear and adjust it, if necessary.

The backlash is considered permissible if play at the lower end of the steering arm (with the front wheels in the straight-ahead position) does not exceed 0.3 mm. In case the play exceeds the above-mentioned value, adjust meshing of the worm and gear so that the play equals zero, since excessive play may cause damage of the steering gear during operation of the vehicle.

The procedure of checking and adjustment of the meshing is as follows.

1. Set front wheels in the straight-ahead position.
2. Disconnect rods from the steering arm.
3. Swing the steering arm by hand to determine play at its end (it is advisable to use the indicating device for the purpose).

If the play exceeds 0.3 mm while the play in the worm bearings equals zero, proceed to adjust as follows:

(a) unscrew the steering gear cap nut and remove the lock washer;

(b) turn the adjusting screw with the wrench clockwise until the play is eliminated;

(c) use the dynamometer to check the effort to be applied to the steering handwheel rim to turn the steering handwheel near its middle position;

(d) adjust the steering effort for 1.2 to 2.5 kgf by turning the adjusting screw;

(e) fit the lock washer. In case one of the holes in the lock washer fails to be aligned on the pin, turn the adjusting screw so as to obtain the required alignment. See that the steering effort is within the specified range;

(f) screw on the cap nut and check the steering arm end play again.

4. Connect the rods to the steering arm.

Adjustment of Toe-In

To determine toe-in, use the bar to measure the distance between the inner edges of the tyres approximately at the wheel centre height and mark the bar-to-tyre contact points. This done, move the vehicle forward or rotate the wheels (in case the vehicle is jacked up) so that the marks are at the same height on the rear side of the tyre and measure the distance between the marked points again. The difference in the measurements will indicate the toe-in which must be 2 to 5 mm.

Toe-in is adjusted by changing the length of the steering gear tie rod. For this purpose, unscrew the tie rod tip pin nut, detach one of the tie rod ends, loosen the tip coupling bolts and adjust the tie rod for the required length by rotating the end tip over the thread.

The steering gear tie rod is bended. So, when performing the adjustment, see that the bended-in portion of the rod does not contact the front axle housing when the front wheels are turned fully to the right or to the left. The clearance between the tie rod and the axle housing neck flange must be 16 mm.

Care of Steering System

When performing maintenance of the steering system, do the following.

1. Check the steering handwheel play and the steering system outer parts for condition (during Daily Maintenance).

2. Check visually all steering system rod connections for proper cottering (during Preventive Maintenance No. 1).

3. Check the steering gear for proper attachment after the first 1000 km of run and tighten up fasteners, if required. Thereafter, this operation is to be performed during every Preventive Maintenance No. 2.

4. Check the steering arm, pendulum and its bracket for proper attachment. See that there is no leakage of oil from the steering gear case. If necessary, stop the leakage, tighten up the fasteners, and replenish the steering gear case with oil until the oil level reaches the hole of the side cover upper bolt (during Preventive Maintenance No. 2).

5. Check and adjust, if necessary, the backlash of the worm-and-gear pair in the steering gear (during Preventive Maintenance No. 2, every 6000 km of run).

6. Check toe-in and adjust it, if necessary (during Preventive Maintenance No. 2, every 6000 km of run).

7. Check and adjust, if required, the steering gear worm bearings (after 15,000 km of run).

8. Lubricate hinge joints of the steering arm (during Preventive Maintenance No. 2, every 6000 km).

9. Replace oil in the steering gear case and lubricant in the pendulum bracket bearings (after 15,000 km of run but at least once every 5 years).

BRAKE SYSTEMS

The vehicle is equipped with two independent brake systems: a service brake system acting on the front and rear wheels, and a parking brake system acting on the transmission.

The service brake system serves for braking the vehicle in motion, whereas the parking brake system is used for braking the vehicle at halt. To brake the vehicle on an ascent exceeding 25°, both the brake systems should be applied simultaneously.

The parking brake system heavily loads the parts of the vehicle transmission, therefore, it is used in motion only in emergency cases when the service brake system fails. It should be kept in mind that application of the parking brake system does not bring on the stop light.

Service Brake System

The wheel brakes are mounted on the axle journals. They are similar for all four wheels and are of a double shoe, closed type. The brake drum inner chamber is sealed to prevent penetration of dirt, water and dust.

To increase braking torque the servobrake principle is employed in these brakes. Owing to the symmetry of the brake shoes provided by the design, the servobrake may be used for reverse running as well. Brake shoes 9 and 5 (Fig. 48) are pressed to anchor pin 2 by springs 1 and 4. The lower ends of the brake shoes are pressed by spring 8 to the adjusting device which receives adjusting screw 7 provided with a sprocket. Spring 8 holds the sprocket against revolution.

Operating cylinder 3 is mounted under anchor pin 2 and activates the shoes with its push rods. The brake drum is bolted to the wheel hub, and its position is predetermined by the setting bead.

When the brake is applied, the front brake shoe dragged by friction force turns a little jointly with the drum, thus wedging up the rear shoe and creating additional braking torque.

The joint between the brake drum and wheel hub is sealed with a rubber sealing ring fitted in the groove of the hub setting bead. Prior to reinstalling the brake drum, coat the sealing ring with a thin film of solid oil.

To check condition of the brake mechanism and to bleed air from the brake fluid system, use the inspection hole closed with a cap that is made in the drum.

A d j u s t m e n t o f B r a k e s

The position of the wheel brake shoe is adjusted as the clearance between the shoes and the drum increases owing to wear of friction linings. For adjustment, the vehicle wheels should be jacked up one after another. Prior to adjustment, check the wheel hub bearings for proper adjustment by swaying the wheel by hand. The brakes cannot be properly adjusted if the bearings play.

To perform adjustment, proceed as follows:

1. Remove brake drum hole cap.

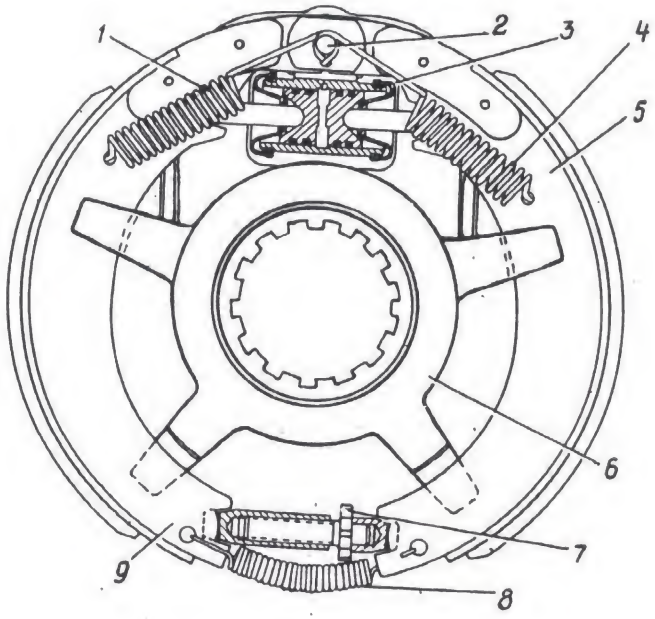


FIG. 48. WHEEL BRAKE
1, 4 and 8 – tension springs; 2 – anchor pin; 3 – operating cylinder; 5, 9 – brake shoes; 6 – bracket; 7 – adjusting screw

2. Use adjusting screw 7 (Fig. 48) to bring apart the brake shoes until they contact the brake drum.

3. Turn in the adjusting screw until the shoes are clear of the drum surface and the wheel rotates freely.

4. Put the cap in place.

When the wheel brakes are properly adjusted, the vehicle must slide upon sharply depressing the brake pedal but not skid.

The adjustment results are to be checked in motion. The braking distance of a normally loaded vehicle running at a speed of 30 km/h over a dry and level section of highway must not exceed 10 m. The brake drums should not overheat with the correctly adjusted brakes. In case of overheating of one or several drums or of poor braking effect, adjustment must be repeated. In the event of poor braking or skidding of the vehicle on braking, check that there is no grease in the brake drums, and readjust the brakes, if required.

Brake Control

The brake control is hydraulic, air-assisted (including a pneumatic booster). The brake control includes suspended brake pedal 8 (Fig. 49), master cylinder 5 with the pneumatic booster, brake valve 7, pipes and wheel cylinders.

Brake pedal 8 is secured on the axle in a bracket bolted to another bracket which is welded to the upper front sloped plate of the vehicle hull. The pedal is connected with pneumatic booster push rod 4 through eccentric adjustment bolt 3, and with double-arm lever 10 of brake valve 7 through rod 9 which can be adjusted in length (the upper end of rod 9 is connected to hole B of the pedal lever).

Backward spring 2 connected to the upper arm of pedal 8 returns the pedal to the extreme rear position. Rubber buffer 1 installed on the upper end of the pedal serves to limit the pedal stroke.

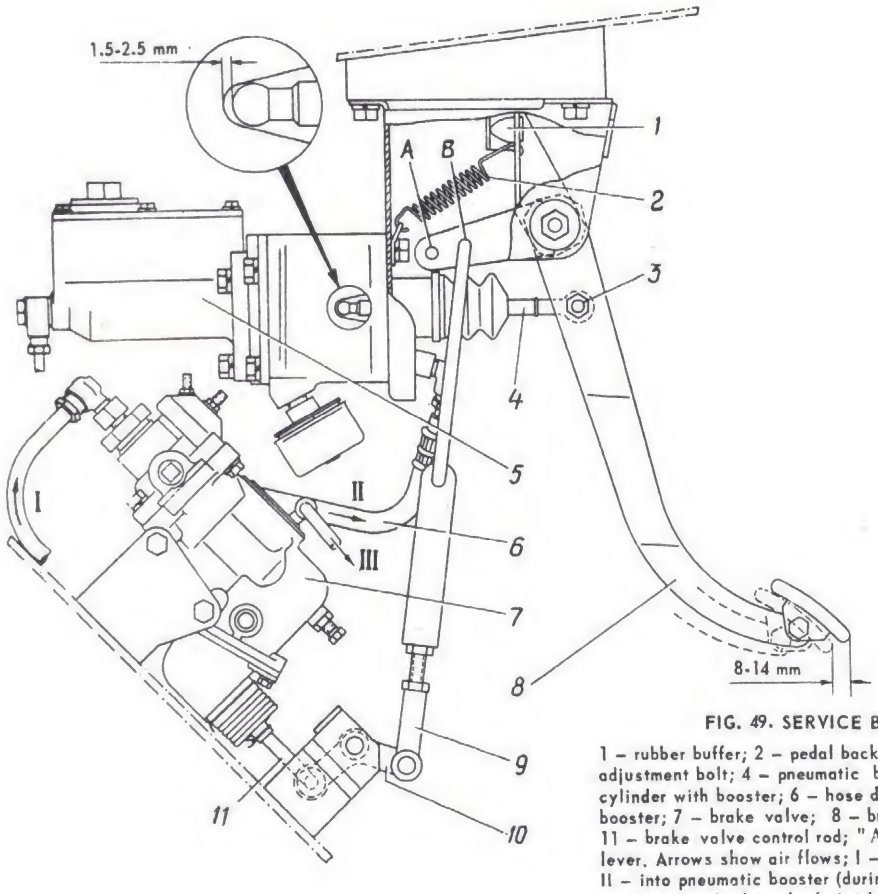


FIG. 49. SERVICE BRAKE CONTROL

1 – rubber buffer; 2 – pedal backward spring; 3 – eccentric adjustment bolt; 4 – pneumatic booster push rod; 5 – master cylinder with booster; 6 – hose delivering compressed air to booster; 7 – brake valve; 8 – brake pedal; 9 – rod; 10 – lever; 11 – brake valve control rod; "A" and "B" – holes in pedal lever. Arrows show air flows; I – from compressed air bottles; II – into pneumatic booster (during braking); III – discharge of air outside the vehicle (with brake pedal released)

Master cylinder 5 of the brake control is bolted to the pneumatic booster and is fastened to the bracket of the brake pedal jointly with the booster.

The brake valve linkage must be adjusted so that delivery of compressed air to the pneumatic booster starts at the beginning of the brake pedal stroke. With the pedal released, air must not flow from the compressed air bottles into the pneumatic booster. Adjust the brake valve linkage by varying the length of rod 9. In case of necessity, change the length of rod 11 of the brake valve linkage.

The pneumatic booster of the brake controls serves to reduce the effort applied to the brake pedal when braking the vehicle.

Piston 12 (Fig. 50) coupled by push rod 4 with master cylinder piston 2 travels inside the booster cylinder due to action of compressed air and the driver's effort applied to the brake pedal. The piston is returned to its initial position by the springs and excessive pressure of operating fluid in the brake hydraulic system.

Piston 12 of the pneumatic booster is sealed by two rubber rings 8 and 13 and felt oil seals 6 and 9. The latter are used for lubrication of the cylinder face thus protecting it against corrosion.

The brake valve serves to deliver compressed air from the vehicle air bottles to the pneumatic booster when applying the brakes and to discharge air from the pneumatic booster when releasing the brakes. The design of the valve ensures proportional distribution of the effort applied to the brake, and air pressure in the pneumatic booster.

When the brake pedal is depressed, the effort is transmitted to rod 9 (Fig. 51) of the brake valve linkage and to lever 1. The latter presses the seat of discharge valve 3 through balancing spring 5 and closes the valve. Then inlet valve 4 opens and

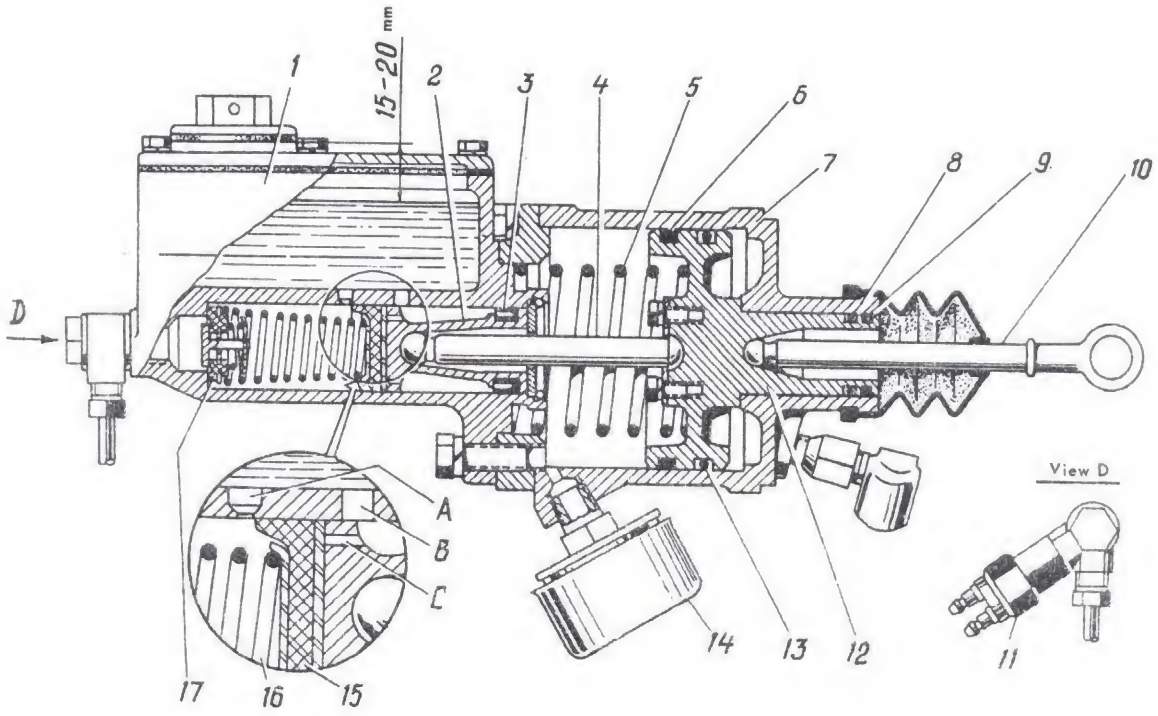


FIG. 50. BRAKE CONTROL MASTER CYLINDER AND BOOSTER

1 – master cylinder; 2 – master cylinder piston; 3, 15 – sealing cups; 4 – master cylinder piston push rod; 5 – spring; 6, 9 – felt seals; 7 – booster housing; 8, 13 – rubber packing rings; 10 – booster piston push rod; 11 – stop light switch; 12 – booster piston; 14 – filter; 16 – return spring; 17 – discharge valve; A – compensating hole; B – by-pass hole; C – piston hole

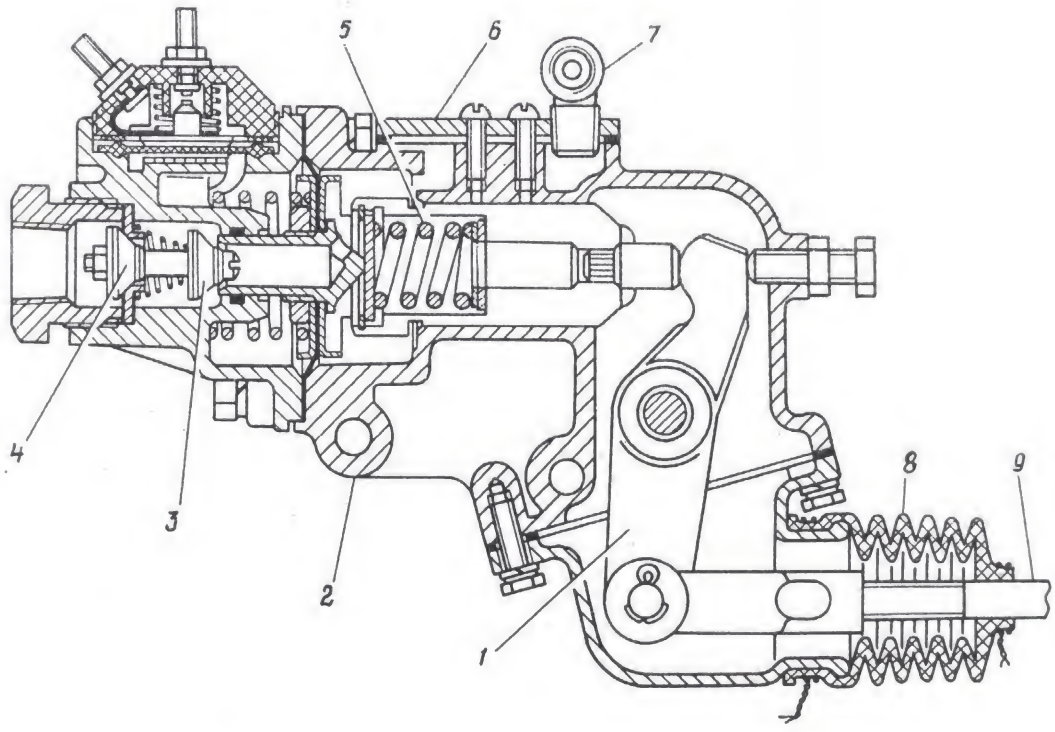


FIG. 51. BRAKE VALVE

1 – lever; 2 – valve body; 3 – discharge valve; 4 – inlet valve; 5 – balancing spring; 6 – cover; 7 – pipe union; 8 – protective cover; 9 – rod

admits compressed air into the pneumatic booster. When the pedal is released, balancing spring 5 expands, thus closing inlet valve 4 and opening discharge valve 3, and compressed air is discharged from the pneumatic booster via pipe union 7 and the pipes out of the vehicle (see Fig. 55).

Adjustment of Clearance Between Pneumatic Booster Push Rod and Piston

This clearance is essential for returning the master cylinder piston into its initial position (until it thrusts against the cover) after the brake pedal is released, or overlapping of the compensating hole by the rubber cup may occur.

The clearance must be 1.5 to 2.5 mm which corresponds to the brake pedal free travel of 8 to 14 mm (see Fig. 49) in the middle of the pedal pad.

The clearance should be adjusted by turning eccentric bolt 3 which connects pedal 8 with push rod 4. To adjust the clearance, proceed as follows:

1. Slacken the nut of eccentric bolt 3 and turn bolt in either direction so that the released brake pedal buffer 1 contacts the limiting bracket and push rod 4 thrusts against the booster piston head (brake pedal has in this case no free travel).
2. Turn eccentric bolt 3 so as to provide the brake pedal free travel of 8 to 14 mm which corresponds to a clearance of 1.5 to 2.5 mm between the booster push rod and the pneumatic booster piston.
3. Tighten the eccentric bolt nut.
4. Check the brake pedal free travel again and repeat the adjustment, if necessary.

Filling of Brake Control Hydraulic System with Brake Fluid

The brake hydraulic system should be filled only with special brake fluid, namely: oil AMT-10.

To fill the brake hydraulic system with brake fluid, proceed as follows:

1. Open the cover on the deck front plate (over the brake control master cylinder).
2. Disconnect rod 9 (see Fig. 49) from lever 10.
3. Screw out the filler plug of the master cylinder and fill it with brake fluid.
4. Remove the cover from the right-side rear wheel brake drum and thoroughly clean the by-pass valve of the wheel brake cylinder of dust. Fit a rubber hose, 850-mm long, on the by-pass valve.
5. Immerse the open end of the hose into a glass vessel (having capacity of at least 1/2 ℓ) containing brake fluid. The vessel must be half-full with the brake fluid (Fig. 52).
6. Give by-pass valve 1/2 to 3/4 turn back and depress the brake pedal several times. Depress pedal quickly and release slowly.

As a result, brake fluid, due to the pressure of the master cylinder piston, will fill the pipeline and force air out.

Pump brake fluid through the master cylinder until no air bubbles appear from the hose immersed into the vessel with the brake fluid. Add some brake fluid into

the master cylinder during air bleeding. "Dry bottom" in the master cylinder is absolutely impermissible, otherwise air will get into the system again.

7. Tightly screw in the wheel brake cylinder by-pass valve (with the brake pedal depressed) and detach the hose.

8. Air bleeding is performed in the following sequence: right-side rear wheel brake, left-side rear wheel brake, right-side front wheel brake, and left-side front wheel brake.

9. After air bleeding from all the four wheel brakes, add brake fluid in the master cylinder up to the level of 15 to 20 mm below the filler hole upper edge, and tightly screw in the plug.

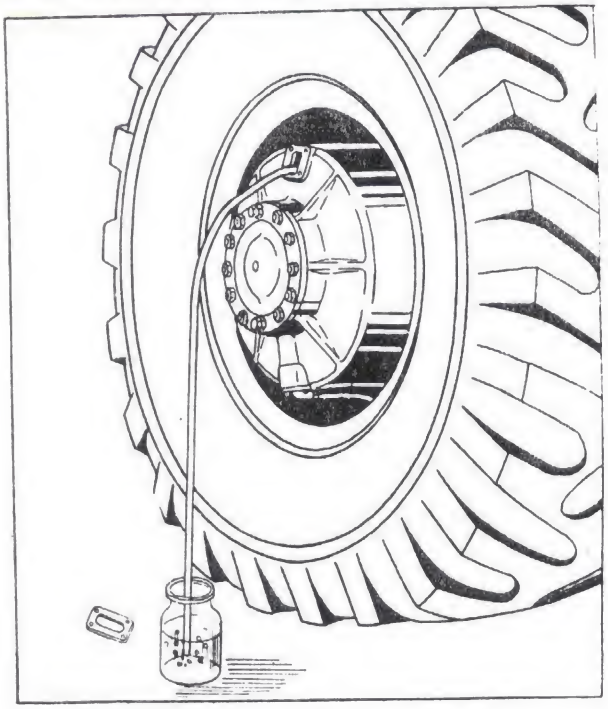


FIG. 52. BLEEDING AIR FROM BRAKE CONTROL HYDRAULIC SYSTEM

The brake fluid used for air bleeding may be used again after air bubbling is over.

If the clearances between the brake shoes and drums are correct and air is evacuated from the hydraulic system, the brake pedal depressed by foot should not go down to more than a half of its full travel, after which the foot must feel a "stiff" pedal. If the brake pedal goes down to more than a half of its full travel, the clearances between the brake shoes and drums are excessive. Feeling of a "soft" pedal which can be depressed nearly up to the stop with negligible resistance indicates air in the brake control hydraulic system.

WARNING: 1. Do not depress the brake pedal when even a single brake drum is removed since pressure in the brake control hydraulic system will force the wheel brake cylinder pistons out and brake fluid will flow off.
2. When assembling the wheel cylinders, always lubricate the pistons and inner surfaces of the cylinders with oil AMГ-10 to prevent seizing of the brakes in operation.
3. Do not apply excessive effort in tightening the master cylinder filler plug, otherwise the threaded portion will be broken.

Parking Brake System

The parking brake system consists of the drum shoe brake mounted on the gearbox secondary shaft and the parking brake linkage.

Adjust the parking brake system when the control lever travel is insufficient for full braking because of excessive clearances between the brake shoes and drums or due to excessive clearances in joints of rods.

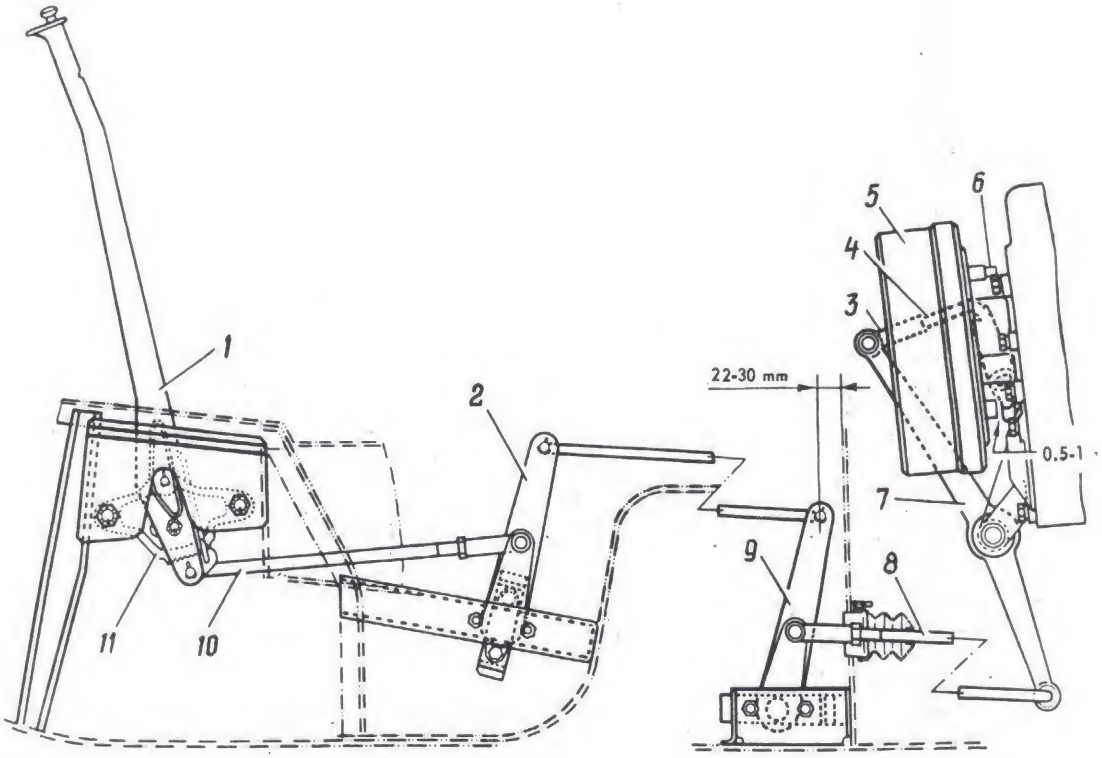


FIG. 53. PARKING BRAKE CONTROL LINKAGE

1 – linkage lever; 2 and 9 – levers; 3 – upper rod adjusting fork; 4 – upper rod; 5 – brake drum; 6 – adjusting screw; 7 – double-arm lever; 8 – rear rod; 10 – front rod; 11 – toothed sector

To adjust the parking brake system, proceed as follows:

1. Set the gearbox lever and transfer case range lever in the neutral position. Set lever 1 (Fig. 53) in the foremost position. In this case brake drum 5 should rotate freely.

2. Screw in adjusting screw 6 so that brake drum 5 cannot be turned by hand.

3. Disconnect fork 3 of rod 4 from lever 7.

4. Disconnect the front end of rod 10 from lever 1, and rotate this rod over the thread on the opposite end to adjust its length so that a distance of 22 to 30 mm is attained between the bulkhead and the axle of lever 9 upon connecting the rod front end to control lever 1.

5. Take up all clearances in the joints and adjust the length of rod 4 by making use of adjusting fork 3 until the hole in the fork aligns with that in double-arm lever 7. In case of necessity, adjustment can be performed by varying the length of rod 8.

6. Reduce the length of rod 4 by giving adjusting fork 3 one or two forward turns, insert the pin, and lock it.

7. Screw off adjusting screw 6 so that brake drum 5 rotates freely when driven by hand.

The clearance between the brake push rod and its lever should be 0.5 to 1 mm.

The parking brake system is adjusted properly if the lever pawl moves along toothed sector 11 through 5 or 6 teeth (klicks) with the effort of 35 to 40 kgf applied to lever 1.

Care of Brake Systems

Maintenance of the brake systems includes the following operations to be performed.

1. Routine Inspection and Daily Maintenance includes:

(a) checking of the service and parking brake systems for proper operation and adjustment of their controls and linkages, if required;

(b) checking of the service brake hydraulic system pipelines and joints for leakage.

2. After first 1000 km of vehicle run, fastening of the brake drums to the wheel hubs must be checked and the bolts must be tightened, if necessary. Further on this operation should be performed during every Preventive Maintenance No. 2.

3. Preventive Maintenance No. 2 includes:

(a) inspection of the brake drums. For checking, open the brake drum hatches. If oil or brake fluid is found inside, remove the drums and eliminate the cause of inleakage. Then wash the friction linings and drum surfaces with gasoline, dry and clean the friction lining surfaces with sand paper;

(b) checking of the level of brake fluid in the master cylinder of the service brake system control and its replenishment in case of necessity.

4. Preventive Maintenance No. 2 every 6000 km of run includes:

(a) removal of the brake drums jointly with the axle shafts and driving flanges, cleaning of the friction linings of dust and adding of lubricant on the outer side of the tyre inflation oil seal unit.

WARNING: When reinstalling the brake drums, pay attention to the position of the hose delivering air to the tyre inflation oil seal unit. The hose must contact neither the drum nor the brake shoe bracket. The hose branch pipe may be bended as required;

(b) checking of the brake valve for tightness. Leakage of air through the discharge hole in the vehicle hull when the brakes are released indicates that the inlet valve is leaky, while leakage when the brakes are applied means that the discharge valve is leaky.

5. After 15,000 km of run, brake fluid in the brake control hydraulic system must be replaced.

Chapter 5

RUNNING GEAR

WHEELS AND TYRES

Used on the vehicle are interchangeable divided-rim disk wheels, size 9.00-18". The wheel is secured to the hub by seven special nuts. The tyres are pneumatic, with controlled inflation pressure, size 13.00-18".

The divided-rim design and use of a spacing ring ensure reliable attachment of the tyre to the wheel rim, thus preventing possible shifting during operation under heavy-road conditions when the tyre pressure is reduced.

The tyre inflation pressure is controlled within the range of 2.8 to 0.7 kgf/cm^2 depending on the road and speed conditions. The tyre pressure should be the same for the front and rear wheels.

Tyre Removal and Installation

To remove the tyre, proceed as follows.

1. Shut the cocks of the tyre cock unit.
2. Shut the wheel cock on the wheel to be removed.
3. Place the jack under the axle housing close to the wheel to be removed. Put the wooden pad included in the driver's tool kit under the jack.
4. Screw out two bolts fastening the elbow union to the brake drum. It is not necessary to detach the pipe connecting the union with the cock, but it is imperative to loosen the pipe by giving the cock nut one or two turns back.
5. Slacken seven thick nuts securing the wheel to the hub, and jack up the wheel.
6. Place a rigid and stable trestle under the vehicle hull. Remove the wheel nuts and take off the wheel.
7. Deflate the tyre by removing the wheel cock jointly with the bracket, pipe and union.
8. Make sure the tyre is deflated and unscrew fourteen thin nuts fastening the detachable rim bead.
9. Remove the detachable rim bead. In case it sticks to its seat, wedge the tyre iron between the tyre and bead at several points over the wheel circle. After the tyre is separated from the rim bead, remove the latter by making use of the tyre irons as levers.
10. Remove the rim in the same manner.
11. Remove the wheel spacing ring upon shifting its lock.
12. Remove the tyre inner tube.

Mounting of tyres is carried out in the reverse order. In doing it, observe the following regulations:

1. See that the wheels are clean and free of damage (corrosion, dents, or burrs). The rim should be regular in shape. Have wheels repaired and painted, if required.

2. Apply talcum powder to the inner tube and the tyre interior. The inner tube and the tyre must be of the same size.

3. Inflate slightly the inner tube placed into the tyre to avoid damage to the former.

4. When mounting the tyre, see that the arrow on the tyre side wall matches the sense of the wheel rotation when the vehicle moves forward. See also that the inner tube valve is positioned properly, without skew.

Care of Wheels and Tyres

The following measures should be taken to ensure reliable and long-term operation of the vehicle wheels and tyres.

1. Check tightening, and tighten up the wheel fastening nuts whenever necessary (during Preventive Maintenance No. 1).

2. Never park the vehicle with deflated tyres, be sure to close air cocks during long halts.

3. Do not drive the vehicle on hard-surface roads when the tyre pressure is reduced. Reduced tyre pressure is allowed only in cross-country driving.

4. Avoid getting of oil or gasoline (kerosene) on tyres. If that occured, wash the tyre with water and wipe dry.

5. Do not paint the tyre side wall with oil paint.

6. Keep the tyres away from direct sun rays as much as possible.

7. Do not let the vehicle be parked without supports for more than 45 days, and see that normal inflation pressure is maintained in the tyres. It is permissible to keep the vehicle without supports for a period of up to six months provided that after every 45 days the tyre support points are changed by turning the wheels through 90° or by moving the vehicle 90 cm every time in the same direction.

8. The vehicles parked for storage for a period exceeding six months should be jacked up so that the wheels are clear of ground; tyre pressure in this case should be reduced to 1 kgf/cm^2.

Procedure for Jacking-Up the Vehicle

When preparing the vehicle for storage as well as during repair and maintenance, it may become necessary to jack up the vehicle.

For jacking-up the БРДМ-2 vehicle, the following equipment must be available:

1. Two hydraulic jacks with handle bars (the vehicle is furnished with one jack).

2. Four wooden bars to be placed under the jacks, size 300 x 110 x 70 mm.

3. Two rigid and stable trestles, 1050 to 1200 mm long, 580 to 600 mm high, and 100 to 120 mm wide (at the top).

4. Waste boards, 1050 to 1200 mm long.

The vehicle should be jacked up on a hard, level ground. The vehicle parking brake must be applied and the 1st or reverse speed gear must be engaged in the gear box.

To jack-up the vehicle, proceed as follows:

1. Install two jacks supported by the wooden bars under the hull close to the axle bay (front or rear) so that the jacks do not hamper installation of the trestles. Places for installation of the jacks and trestles are shown in Fig. 54.

2. Hoist the vehicle hull simultaneously with two jacks up to the height of the trestle.

3. Place the trestle under the hull and lower the latter on the trestle.

4. Hoist the other end of the vehicle hull with the jacks and place it on the other trestle.

5. Use the jacks and the wooden bars to further hoist alternately the front and rear of the hull while placing boards between the hull and trestles until the wheels are clear of ground. Lower the auxiliary wheels.

The vehicle is removed from the trestles in the reverse order.

When putting the vehicle on and removing it from the trestles, observe the following safety rules:

(a) install jacks and wooden bars underneath properly and reliably; observe the safety precautions;

(b) Hoist and lower the vehicle hull with the jacks smoothly and evenly.

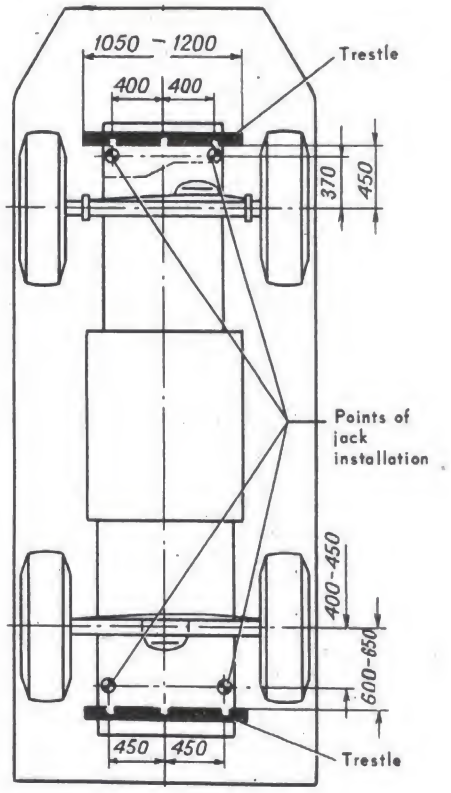


FIG. 54. POSITION OF JACKS AND TRESTLES WHEN JACKING-UP БРДМ-2 VEHICLE

TYRE PRESSURE CONTROL SYSTEM

The vehicle is equipped with a tyre pressure control system that ensures control by the driver of the tyre inflation pressure when the vehicle is at halt or in motion depending on the type of the road surface and speed of movement. The system also permits monitoring of the pressure in each tyre.

Reducing the tyre pressure when moving over soft ground decreases the specific ground pressure and increases the vehicle cross-country ability. In case of a bullet puncture or other minor damage to the inner tube, the tyre pressure control system enables further movement of the vehicle without immediate replacement of the damaged wheel since the compressor makes up for air leakage from the inner tube.

The tyre pressure control system consists of compressor 10 (Fig. 55), pressure regulator 9, two air bottles 5, non-return valve 11, air reducer 1, tyre cock unit 3, tyre pressure gauge 2, air bottles pressure gauge 12, air cocks in the wheels, pipelines and hoses.

The tyre pressure control system operates as follows. Air from compressor 10 is delivered into air bottles 5 and therefrom, through the pipeline fitted via non-return valve 11, into air reducer 1. The air reducer communicates with the wheel tyre inner tubes through tyre cock unit 3, and pipelines. The tyre pressure is automatically maintained in compliance with the position of the pointer in the air reducer scale.

When the air reducer knob is turned counterclockwise air is admitted in the wheel tyre inner tubes (inflation). When the knob is turned in the opposite direction, air is released from the tyres.

The air compressor (Fig. 56) is of a piston, non-direct-flow, double-cylinder, single-stage type. The compressor cylinder block and cylinder head are cooled by liquid supplied from the vehicle engine cooling system.

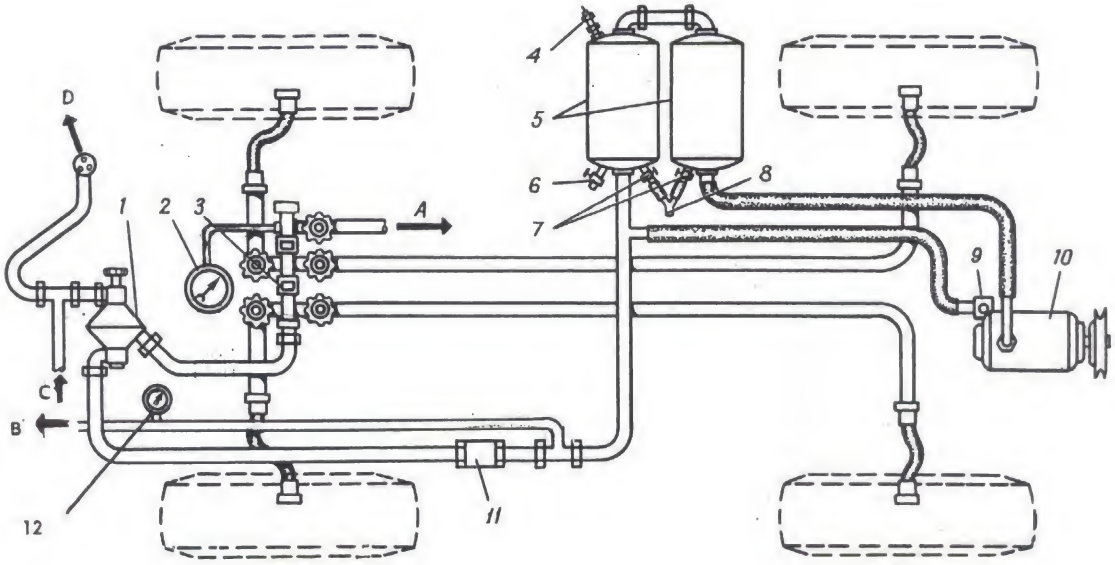
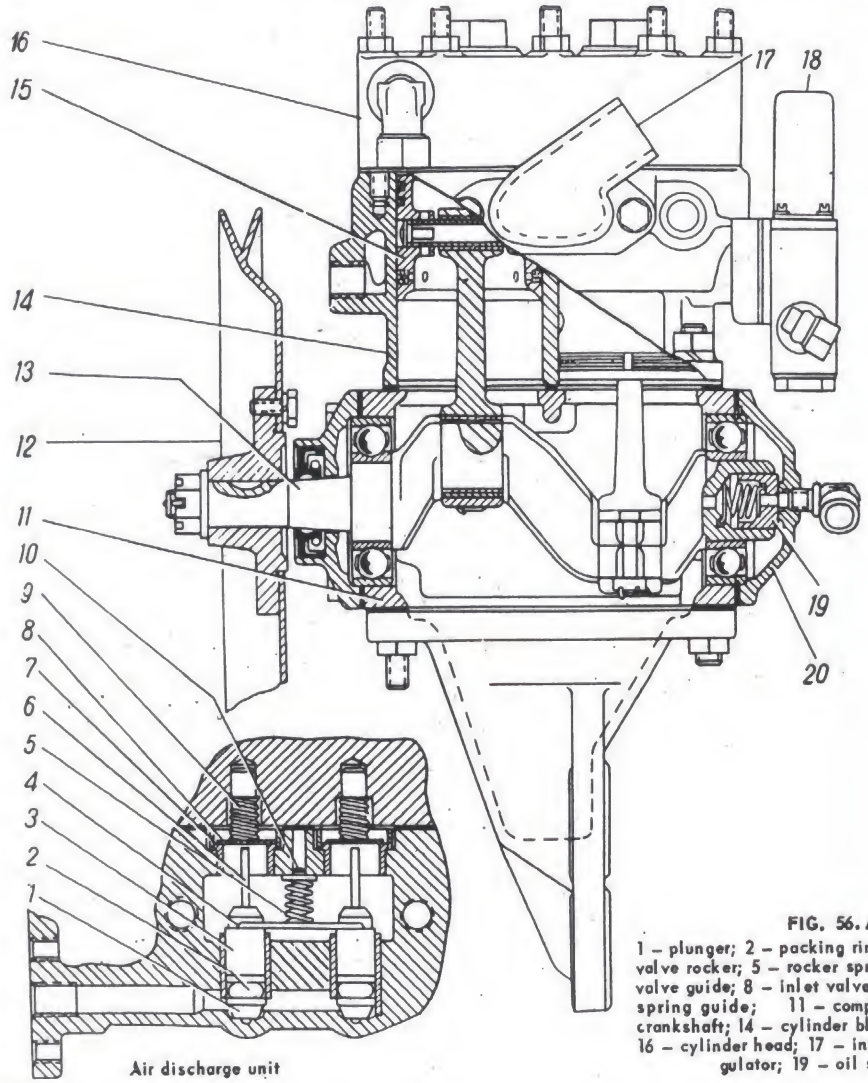


FIG. 55. TYRE PRESSURE CONTROL SYSTEM

1 – air reducer; 2 – tyre pressure gauge; 3 – tyre cock unit; 4 – safety valve; 5 – air bottles; 6 – air bleed cock; 7 – drain cocks; 8 – drain pipe union; 9 – pressure regulator; 10 – compressor; 11 – non-return valve; 12 – air bottles pressure gauge; A – air bleed; B – to brake valve; C – from brake valve; D – air discharge



Air discharge unit

FIG. 56. AIR COMPRESSOR

1 – plunger; 2 – packing ring; 3 – inlet valve rod seat; 4 – inlet valve rocker; 5 – rocker spring; 6 – inlet valve rod; 7 – inlet valve guide; 8 – inlet valve; 9 – inlet valve spring; 10 – rocker spring guide; 11 – compressor housing; 12 – pulley; 13 – crankshaft; 14 – cylinder block; 15 – piston and connecting rod; 16 – cylinder head; 17 – intake branch pipe; 18 – pressure regulator; 19 – oil seal; 20 – housing rear cap

The compressor is driven by a V-belt running from the engine crankshaft pulley.

When the air pressure in the system becomes as high as 7.3 to 7.7 kgf/cm^2, pressure regulator 18 starts supplying compressed air from the air bottles to under plungers 1 of the air discharge unit through the cylinder block channel. The plungers go up and open inlet valves 8 of the two cylinders. Now air is no longer fed into the system since it freely flows from one cylinder to the other. As soon as the air pressure in the system drops to 6.4 to 6 kgf/cm^2, the pressure regulator discharges air from under the plungers into the atmosphere. The plungers slide down, release the inlet valves and the compressor starts pumping air into the pressure control system again.

Oil for lubrication of friction surfaces is delivered along the oil pipeline of the engine via the hose. It comes first to the compressor housing rear cover and through seal 19, and then, going along the channels in crankshaft 13, reaches the crankpin bearings. Main ball bearings, piston pins and cylinder faces are splash-lubricated. Oil from the compressor housing returns to the engine crankcase through the hose.

The detachable compressor cylinder head is fastened to the cylinder block by eight studs. The cylinder block-and-head joint is sealed with a paronite gasket. The cylinder head nuts should be tightened in two stages by following the sequence shown in Fig. 57. The nut tightening torque should be 1.2 to 1.7 kgf·m.

Air from the air filter is delivered into the compressor cylinder through the self-acting plate inlet valves.

The compressor drive belt tension is adjusted by tilting the compressor in the slots made in its lower cover. The belt should be tightened so that, when a pressure of approximately 4 kgf is applied by hand to the middle of the belt upper run between the compressor and the water pump pulleys, the belt deflection ranges from 10 to 15 mm.

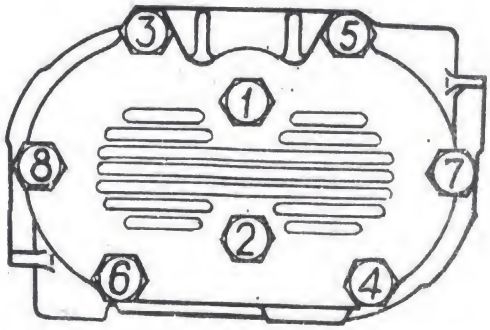


FIG. 57. SEQUENCE OF TIGHTENING OF COMPRESSOR CYLINDER HEAD NUTS

The pressure regulator (Fig. 58) is mounted on the compressor cylinder block and automatically maintains the pressure in the system within 6 to 7.7 kgf/cm^2. The pressure regulator has two filters: metal ceramics filter 2 and gauze filter 14.

The regulator maintains the required pressure in the system by delivering or discharging air from the compressor discharge chamber. When the pressure reaches 7.3 to 7.7 kgf/cm^2, the regulator cuts off air delivery from the compressor, and when the pressure drops to 6.4 to 6 kgf/cm^2, the regulator cuts it in again.

The pressure regulator is adjusted in the following way.

Rotate regulating cup 12 to adjust the compressor for commence of air delivery at a pressure of 6 to 6.4 kgf/cm^2. The adjusted pressure is increased if the cup is screwed in, and is decreased if the cup is screwed off. The cup is locked by lock nut 9.

Vary the number of shims 7 to adjust the air cur-off pressure for 7.3 to 7.7 kgf/cm^2. The pressure is decreased when the number of shims is increased, and vice versa.

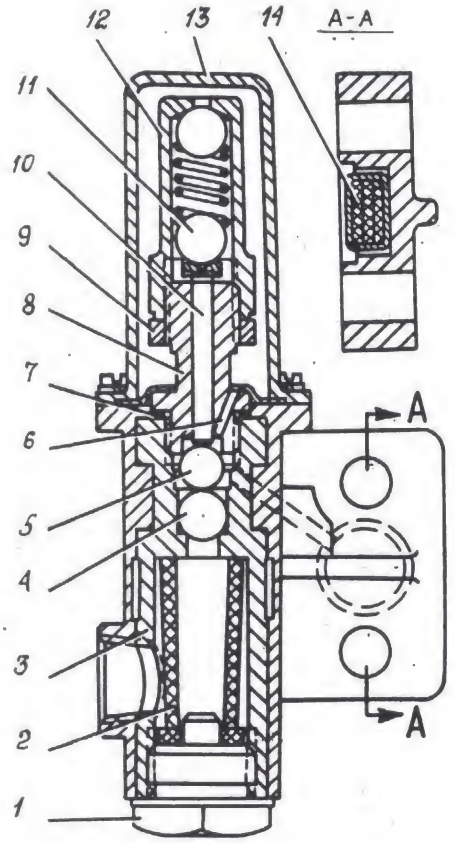


FIG. 58. PRESSURE REGULATOR

1 – filter plug; 2 – metal ceramics filter; 3 – valve body; 4 – inlet valve; 5 – discharge valve; 6 – discharge channel; 7 – shims; 8 – discharge valve seat; 9 – regulating cup lock nut; 10 – valve rod; 11 – thrust ball; 12 – regulating cup; 13 – casing; 14 – gauze filter

Air bottles 5 (see Fig. 55) are installed behind the engine bulkhead, in front of the right-side rear wheel bay, and interconnected in series by a pipeline. Condensate accumulated in the air bottles is removed through drain cocks 7 fitted on each bottle, and is discharged outside the vehicle hull through drain pipe union 8. Installed in the front bottle are safety valve 4 and cock 6 used for inflation of the auxiliary wheel tyres and for other operations that require compressed air.

The non-return valve (Fig. 59) is arranged in the main from the air bottles to the air reducer. It prevents discharge of air from the tyres into the air bottles if the pressure in the air bottles is lower than that in the tyres.

The safety valve (Fig. 60) is arranged in the front air bottle to protect the system against excessive rise of the pressure in case of failure of the automatic pressure regulator.

The safety valve is adjusted so that it opens at a pressure of 9 to 9.5 kgf/cm^2 in the system. Its adjustment is carried out by using screw 6 with lock nut 5.

The air reducer (Fig. 61) is of a sealed type. It is located in front of the driver's seat, to the left of the driver. Gasket 5 and sealing rings 17 prevent penetration of air into the driving compartment from the air reducer.

The air reducer is an automatic device which permits advance selection (presetting) of the required value of air pressure on scale 3 depending on the road conditions, and maintaining of the preset pressure in motion. The driver rotates knob 1 to set the selected pressure on the instrument scale.

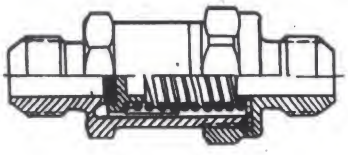


FIG. 59. NON-RETURN VALVE

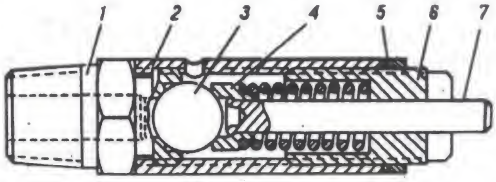


FIG. 60. SAFETY VALVE

1 – seat; 2 – valve body; 3 – ball; 4 – guide stem retainer; 5 – lock nut; 6 – adjusting screw; 7 – spring guide stem

The accuracy of the pressure preset by the air reducer is about 0.3 kgf/cm^2, therefore the final pressure in the tyres is set by the reference tyre pressure gauge located on the instrument panel. In case of puncture in the inner tube (drop of pressure in chamber "B") the air reducer automatically opens inlet valve 12, and the vehicle still can run if, of course, the capacity of the compressor is sufficient to make up for the leaking air.

At long halts the valves of the tyre cock unit should be closed, and in durable parking it is also expedient to close the wheel cocks to prevent air escape from the tyres resulted from non-tightness of the system.

If air leaks from one of the wheels of the parked vehicle, its cock should be closed to prevent air leakage from the other wheels.

The automatic air reducer operates as follows.

At a steady operating condition, i.e. when air pressure in chamber "B" (under main diaphragm 9) is balanced by action of main spring 8, outlet valve 16 and inlet valve 12 are both closed (pressed to their seats).

To increase the tyre pressure (to inflate tyres), it is necessary to increase the force exerted by main spring 8. This is effected by turning knob 1 counterclockwise. The air reducer readings are taken from scale INFLATION (НАКАЧКА). The force of main spring 8 is transmitted via main diaphragm 9, outlet valve 16 and rod 13 to inlet valve 12. The latter opens and lets air from chamber A to chamber B, and further, to the wheel tyres. As soon as air pressure in chamber B (and consequently, in the tyres) exerts a certain pressure on the diaphragm surface (outlet valve 16 is now pressed to its seat) that overcomes the action of main spring 8, inlet valve 12 closes and remains closed until balance of forces is lost again (pressure is reduced in chamber B or force of main spring 8 is increased; in both cases the inlet valve opens again).

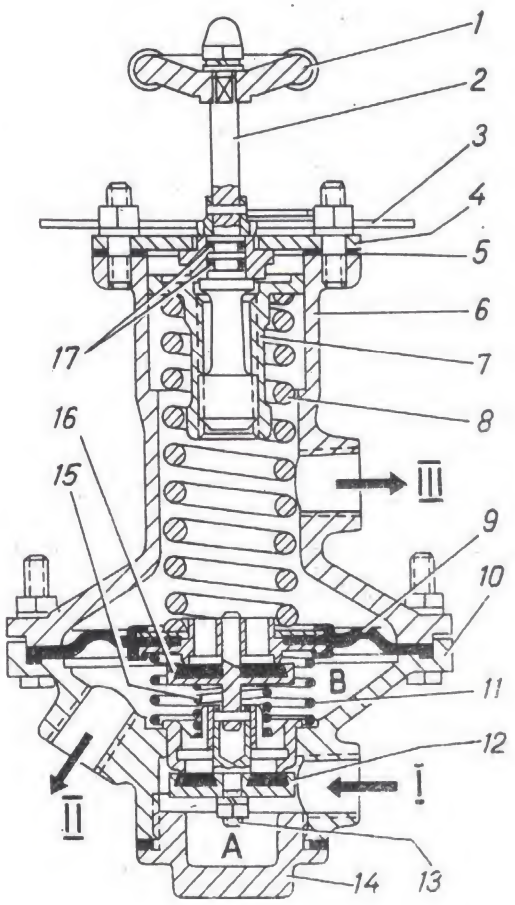


FIG. 61. AIR REDUCER

1 – knob; 2 – screw; 3 – scale; 4 – support; 5 – gasket; 6 – body cover; 7 – nut; 8 – main spring; 9 – main diaphragm; 10 – reducer body; 11 – spring; 12 – inlet valve; 13 – rod; 14 – body plug; 15 – spring; 16 – outlet valve; 17 – sealing rings; A and B – chambers
Arrows show direction of air flow:
I – from compressor; II – to tyres; III – to atmosphere

To reduce the tyre pressure (to deflate tyres), it is necessary to decrease the force of main spring 8. This is effected by turning knob 1 clockwise. As this takes place, main diaphragm 9 goes up and air is discharged through a circular slot between the outlet valve and its seat and then through the special discharge pipeline into the atmosphere. As the action of main spring 8 (with the selected value of pressure on the air reducer scale) balances pressure in chamber B, outlet valve 16 becomes closed.

The tyre cock unit (Fig. 62) is located to the left of the driver's seat. The unit has five cocks with knobs.

Four cocks are connected to the vehicle tyres. The connection diagram is shown on the tyre cock unit control board. The fifth cock serves for take-off of compressed air. It can be opened for taking-off of compressed air only when the air-to-wheel delivery cocks are shut.

When the cocks of the tyre cock unit and wheel cocks are opened, all tyres are interconnected through the tyre cock unit and hence, their pressure is equal. Inflation or deflation of tyres in this case takes place simultaneously in all wheels.

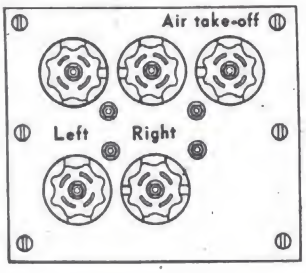


FIG. 62. TYRE COCK UNIT WITH CONTROL BOARD

The tyre pressure is indicated on the air reducer scale and repeated by the tyre gauge.

To determine the leaky tyre (in case of puncture, for instance), shut all cocks of the tyre cock unit and defect the damaged tyre by opening the cocks one after another.

Air delivery to the front and rear wheel tyres is similar. Air is supplied to wheel rotating drum 1 (Fig. 63) through the bore drilled in journal 10, air delivery nipple 8, adapter pipe 5, adapter nipple 6 installed in adapter pipe union 7 and screwed in seal unit 9, and then through bores in the knuckle (or the axle shaft in the rear axle), and channels in driving flange 2 and drum 1.

Seal unit 9 is of a split, floating type. It consists of a housing, rubber cups complete with springs, covers and lock rings. The seal unit is retained by air delivery nipple 6. Air delivery nipple 6 and adapter pipe union 7 are jointly sealed by a rubber ring and protective cap 3.

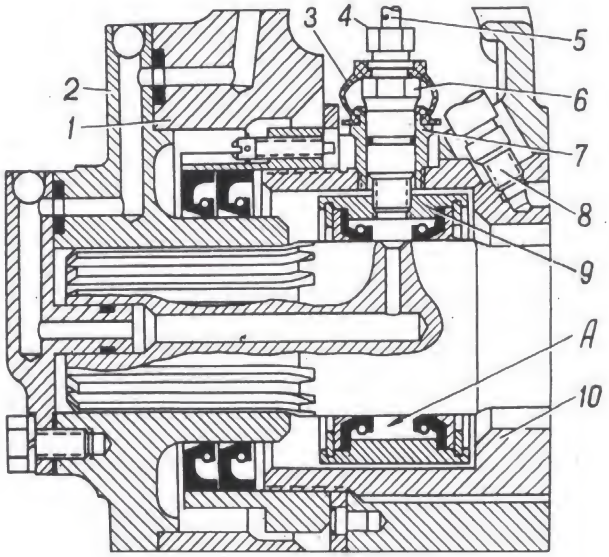


FIG. 63. AIR DELIVERY SYSTEM SEALING

1 – drum; 2 – driving flange; 3 – protective cap; 4 – nut; 5 – adapter pipe; 6, 8 – air delivery nipples; 7 – adapter pipe union; 9 – tyre inflation seal unit; 10 – journal; A – cavity between seals

When screwing out air delivery nipple 6, it is necessary to shift portective cap 3 onto adapter pipe 5 and then, holding the air delivery nipple with a wrench, unscrew coupling nut 4 of pipe 5.

Air delivery nipple 6 should be removed jointly with pipe union 7 after screwing them out of journal 10 and seal unit 9.

Prior to removing seat unit 9, dismantle brake drum 1. Before reinstalling the seal unit, fill chamber A with 15 g of lubricant ЦИАТИМ-201 and lubricate the seal

unit on the inside and outside to avoid dry friction and scorching of the working edges of the seals.

When mounting driving flange 2, see that the drum air hole is aligned with the flange hole.

Care of Tyre Pressure Control System

1. Since the moment the vehicle comes into the service, see that the tyre pressure control system is airtight. During maintenance of all types it is necessary to detect and stop all possible air leaks. Pay particular attention to tightness of pipelines and flexible hoses where loose connections are most often. Heavy air leak may be determined audially while slight leaks are detected by making use of soap foam which is applied to the suspected leak points. Tyre pressure drop when the wheel cocks are opened and the cocks in the tyre cock unit are shut should not exceed 0.25 kgf/cm^2 for five hours (with the tyres as cool as the ambient temperature).

2. At long halts and in parking of the vehicle outdoors in cold season, ice locks may take place in the tyre pressure control system due to freezing of condensate. In order to avoid formation of the ice locks, the system should be blown with compressed air prior to parking or storing the vehicle. To do this, inflate the tyres to 3.2 kgf/cm^2 and reduce the tyre pressure to 2.8 kgf/cm^2 by means of the air reducer. This procedure helps to remove the condensate from the system.

3. Daily Maintenance must include the following operations:

(a) checking and adjustment, if required, of the compressor drive belt tension. Properly tightened belt should have sagging of 10 to 15 mm when a hand effort of 4 kgf is applied in the middle of the belt upper run;

(b) draining of condensate from the air bottles.

4. Preventive Maintenance No. 2, after each 6000 km of run, must include adding of lubricant on the outside of the tyre pressure control seal unit.

TYRE PRESSURE CONTROL SYSTEM TROUBLES AND REMEDIES

Symptom and cause	Remedy
System pressure fails to rise to 6-7.7 kgf/cm^2 with engine running*:	
(a) air leakage through safety valve;	Remove safety valve, disassemble it, thoroughly wash in kerosene (gasoline) and dry. Seat bead and ball must have no scores or damaged surfaces. After assembly safety valve spring should be adjusted so as to ensure full opening of valve at pressure from 9 to 9.5 kgf/cm^2. Pull the rod to make sure valve functions properly (air escapes from air bottles)
(b) loose compressor drive belt tension;	Adjust belt tension

* Pressure must be checked with the reference pressure gauge with the vehicle in the stationary state.

Symptom and cause	Remedy
(c) air leakage through joints in pipeline running between compressor and air reducer;	Tighten joints, replace damaged parts
(d) maladjustment of pressure regulator;	Adjust pressure regulator
(e) worn compressor cylinder piston rings;	Send compressor for repair
(f) loose fitting of compressor valves;	Send compressor for repair
(g) seizure of piston in non-return valve cylinder	Remove non-return valve, disassemble, clean of carbon deposit, wash in gasoline, coat with thin film of engine oil, assemble and fit home
System pressure drops rapidly with engine inoperative, and cocks of tyre cock unit and wheel cocks opened:	
(a) air leakage through pipe joints;	Tighten joints, replace damaged parts
(b) faulty air reducer;	Send air reducer for repair
(c) air leakage through safety valve;	See above
(d) damaged tyre inner tube	Replace damaged inner tube
(e) air leakage through sealing cups due to loss of elasticity or wear of cup working edges	Replace sealing cups

SUSPENSION

The vehicle suspension employs longitudinal semielliptic springs. Each suspension (front and rear) consists of springs which are similar for both suspensions, and one main and one additional reaction buffers.

All the springs are secured to the vehicle hull through rubber pads (three pads for the front ends and two for the rear ones). The spring attachment to the vehicle is shown in Fig. 64. Riveted to the ends of the two main spring leaves are special cups. The front end cups are open on the side facing the middle of the spring, and the rear end cups have all-round beads. The cups house the rubber pads which jointly with the spring ends are clamped in the brackets by the covers.

Installed in the special seats in the spring front brackets are rubber stops 1 that transmit force of impact to the vehicle hull. Longitudinal shift of the springs that is necessary because of spring deflection is enabled by freedom of their rear ends.

Such spring attachment ensures smooth and noiseless running and durability, and requires no lubrication. The spring deflection is limited by the main rubber buffers. Main buffer 8 is mounted on the spring, and additional buffer 10 is secured to the vehicle hull.

The vehicle axle assemblies are secured to the springs by U-bolts 6 which should be reliably tightened during operation. When tightening up the spring U-bolts, use should be made of the double-head wrench for tightening spherical bearing nuts (19x22) in addition to the spring U-bolt nut wrench. This is done to increase the tightening torque by lengthening the arm. The wrenches are interconnected by a coupling block inserted into their openings as shown in Fig. 65.

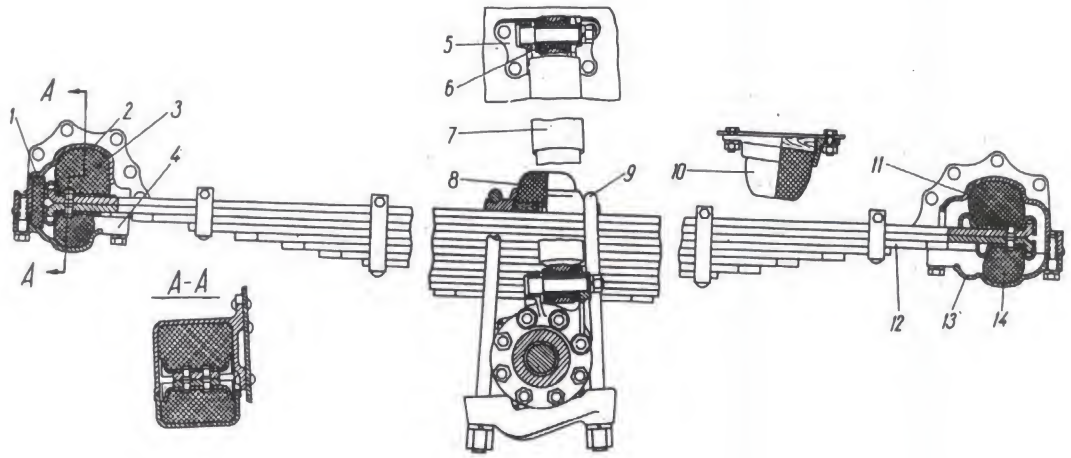


FIG. 64. FRONT SUSPENSION

1 – spring stop; 2 – front bracket; 3 – upper support; 4 – front bracket cover; 5 – upper bracket; 6 – shock absorber eye bushing; 7 – shock absorber; 8 – main buffer; 9 – U-bolt; 10 – additional buffer; 11 – rear bracket; 12 – spring; 13 – rear bracket cover; 14 – lower support

Care of springs implies regular cleaning of dirt (during Daily Maintenance). The spring leaves are lubricated with graphite grease when the springs start to "squeak", and by all means after 15,000 km of run. This prevents corrosion of the spring leaves which is the main cause of the spring breakage in operation.

After first 1000 km of run, check the spring U-bolts for tightening and tighten them up, if required. Further on, do this during Preventive Maintenance No. 2. Check condition of the springs visually during Preventive Maintenance No. 1.

The rubber pads of the springs should be replaced when found worn.

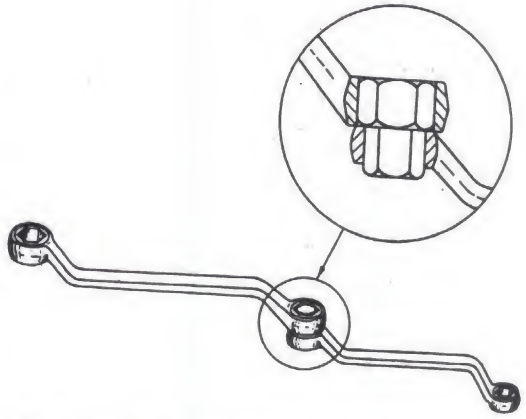


FIG. 65. APPLICATION OF WRENCH COUPLING BLOCK

When mounting the springs on the vehicle, coat the bracket cover bolts with grease AMC-3 or other water-resistant lubricant.

Shock Absorbers

Four telescopic double-acting shock absorbers (Fig. 66) are installed in the vehicle to cushion joilting resulted from road humps.

The shock absorbers are attached to the vehicle hull and driving axles by means of pins and rubber tapered bushes clamped by nuts.

Used as operating fluid is oil АМГ-10, GOST 6794-75. As a substitute, shock-absorber fluid АЖ-12Т, may be also used. Capacity of one shock absorber is 505 to 515 cm^3. Bear in mind that excessive amount of operating fluid in the shock absorber leads to its breakage, and insufficient amount causes long idle stroke.

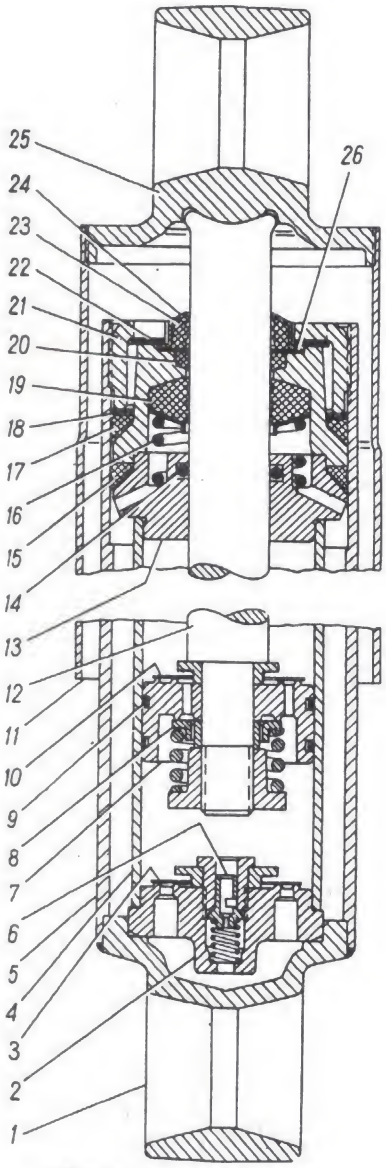


FIG. 66. SHOCK ABSORBER

1 – lower eye; 2 – compression valve body; 3 – inlet valve; 4 – cylinder; 5 – reservoir; 6 – compression valve; 7 – piston; 8 – rebound valve; 9 – piston cast iron ring (2 pcs); 10 – by-pass valve; 11 – housing; 12 – rod; 13 – guiding bush; 14 – rubber ring; 15, 17 – shock-absorber reservoir rubber sealing rings; 16 – oil seal spring; 18 – steel washer; 19 – rubber seal preventing oil leakage through shock-absorber-to-rod joint; 20 – felt oil seal; 21 – nut; 22 – aluminium washer; 23 – rubber seal preventing shock absorber against penetration of dirt along rod during compression stroke; 24 – oil seal holder; 25 – upper eye; 26 – steel spacer

Care of the shock absorbers implies regular cleaning of dirt (during Daily Maintenance). The shock absorbers are checked visually for condition and fastening during Preventive Maintenance No. 1.

The shock absorbers are designed for a long service life, and therefore they may be disassembled only in repair shops and in case of real necessity. The typical shock absorber troubles are leakage of operating fluid and loss of resistance.

The symptom of the shock absorber trouble is long swinging of the vehicle after negotiating the road humps.

In order to check serviceability of the shock absorber on the vehicle, disconnect its lower end and try to pump it by hand. A serviceable shock absorber will offer certain resistance, but a faulty one will yield, have temporary lost of resistance or get seized.

Failure of the shock absorber or reduction of its efficiency is normally caused by clogging of its valve systems or damage to its parts. In this case the shock absorber must be removed from the vehicle, stripped down, and washed, and its damaged parts, if any, must be replaced.

All operations to remedy the shock absorber troubles must be carried out in the repair shop. Every precaution should be taken to prevent contamination of the shock absorber inner cavities during their disassembly and assembly.

If oil leakage is detected, tighten nut 21 with the tightening torque of 7 to 8 kgf·m. If the trouble still persists, thoroughly wash the shock absorber on the outside, unscrew nut 21 and inspect sealing elements. Replace the faulty ones. Rod rubber seal 19 bears inscription BOTTOM (НИЗ) on its end face. This inscription should face the shock absorber bottom (i.e. the shock absorber piston).

To decrease wear of the rubber oil seals, their inner surfaces that contact the rod should be coated with a film of ЦИАТИМ-201 lubricant prior to installation of the oil seals.

Chapter 6

TRENCH-NEGOTIATING EQUIPMENT

GENERAL

The vehicle is equipped with special trench-negotiating equipment. The latter includes four auxiliary wheels (two on each side) located between the road wheels.

The auxiliary wheels are raised and lowered by means of a hydraulic control which is a part of the vehicle hydraulic system (see Chapter 8 "HYDRAULIC SYSTEM").

The auxiliary wheels are driven by the transfer through a special power take-off (see Figs 33 and 37), propeller shafts and chain drives.

The auxiliary wheels power take-off is engaged by control lever 6 (see Fig. 36) through rod 4. Lever 6 is retained in the disengaged position by a folding strap. To engage the auxiliary wheels power take-off, raise the folding strap and shift control lever 6 forward (towards the vehicle front).

The auxiliary wheels are pneumatic, aircraft-type, size 700x250 mm. The tyre operating pressure is 5.5 to 6 kgf/cm^2. Tyre 9 (Fig. 67) with inner tube 10 are attached to the hub by means of rim flange 11 and split locking ring 12.

The tyres are inflated through tyre valve 6.

The wheel is mounted on the rocker arm shaft in two tapered bearings 5.

Auxiliary wheel shaft 3 is essentially a crank with a splined web. The crank shaft is retained in the required position in the course of the chain tension adjustment by making use of retainer 17 fastened by two bolts 18 to rocker arm 13. A hexahedral opening for the socket wrench is provided in the shaft bore on the side facing the rocker arm. The socket wrench is used for turning the crank when adjusting the auxiliary wheels chain tension.

The auxiliary wheel rocker arms are suspended on each side in pairs on the axles. One end of each axle is attached to the vehicle hull side plate, and the other, to a special bracket welded in the auxiliary wheels bay. Fitted in the rocker arm shaft end face is a lubrication fitting.

Auxiliary Wheels Drive

Torque is transmitted from the power take-off to driving sprockets 6 (Fig. 68) by two propeller shafts (right and left). The universal joints are similar in construction and size for both the shafts, but the propeller shafts proper are different (non-interchangeable).

From the driving sprockets torque is transmitted to the auxiliary wheels driven sprockets by means of sleeve-roller, single-strand chains. The number of teeth on the

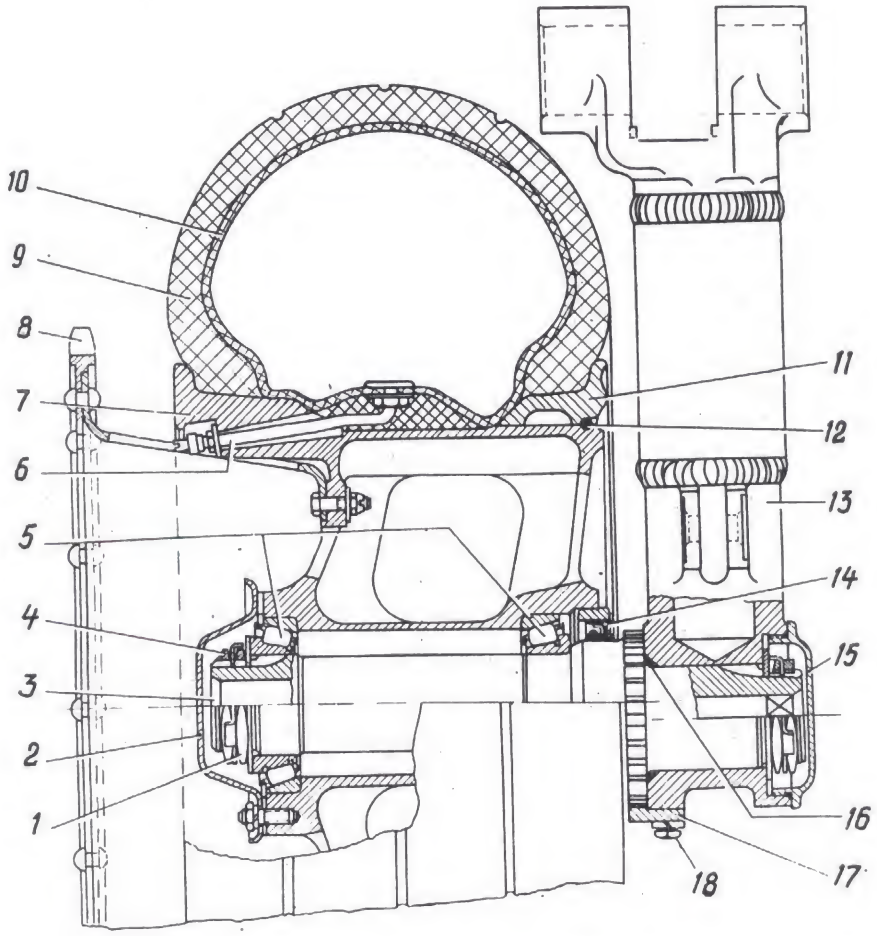


FIG. 67. ATTACHMENT OF AUXILIARY WHEEL

1 – nut; 2 – hub cap; 3 – shaft; 4 –lock nut; 5 – bearings; 6 – valve; 7 – hub; 8 – driven sprocket; 9 – tyre; 10 – inner tube; 11 – rim flange; 12 – locking ring; 13 – rocker arm; 14 – oil seal; 15 – plug; 16 – sealing ring; 17 – retainer; 18 – bolt

driving sprocket is 12 and on the driven one,51. Chain pitch is 25.4 mm. The chain ends are coupled by means of an adapter link and a coupling link. To remove the chain, it is necessary to uncotter the adapter link shaft and drive it out.

When installing the auxiliary wheels, adjust their position by making use of adjusting washers 4 so that the driving and driven sprockets are in the same plane (permissible misalignment is 1 mm, max).

Adjustment of Chain Tension

The chain tension can be adjusted by turning the auxiliary wheel axle which is mounted eccentrically relative to the rocker arm shaft. The chain tension adjustment should be carried out upon lowering the auxiliary wheels. To adjust chain tension, remove the auxiliary wheel axle toothed stop and use the hexahedral socket wrench from the driver's tool kit to rotate the axle until the chain tension is such that sagging in the middle of the driven run is 5 to 15 mm. Then install the toothed stop in place and secure it. If the chain is too weak, remove one link from the chain.

When the chain is broken, take out the broken link and reconnect the chain with the spare link.

Adjustment of Auxiliary Wheel Bearings

The auxiliary wheel bearings are adjusted when axial or radial play of the auxiliary wheel is detected.

When performing the adjustment, see that the auxiliary wheel does not contact the ground.

To perform the adjustment, proceed as follows.

1. Rotate the wheel by hand and simultaneously tighten the nut (first from the bearing) on the rocker arm shaft until the wheel rotates with difficulty. Rotation of the wheel is required for correct positioning of the rollers in the bearings. The nut should be tightened with one hand using a wrench 300 to 350 mm long.
2. Slacken the nut by giving 1/6 of a turn back.
3. Put the lock washer, and screw on and tighten the second nut.
4. Check the bearings for adjustment. (If properly adjusted, the wheel should rotate easily without end play and rocking).
5. Bend two opposite tabs of the lock washer onto the side faces of the first and second nuts.

Inflation of Auxiliary Wheel Tyres

To inflate the auxiliary wheel tyres, proceed as follows.

1. Shut cocks of the tyre cock unit.
2. Release air from the air bottles through the drain cocks.
3. Remove the stopper and connect the tyre inflation hose (available in the SPTA set) to the air take-off valve fitted on the front air bottle.
4. Start the engine.
5. Lower auxiliary wheels to the operating position and connect the other end of the hose to the wheel inner tube valve.

The compressor builds up high air pressure in the air bottles; therefore, when inflating the auxiliary wheel tyres, check from time to time their pressure with the tyre gauge provided in the vehicle SPTA set and bleed excessive air, if this is necessary (normal operating pressure is 5.5 to 6 kgf/cm^2).

Care of Trench-Negotiating Equipment

1. When carrying out Daily Maintenance, do the following:

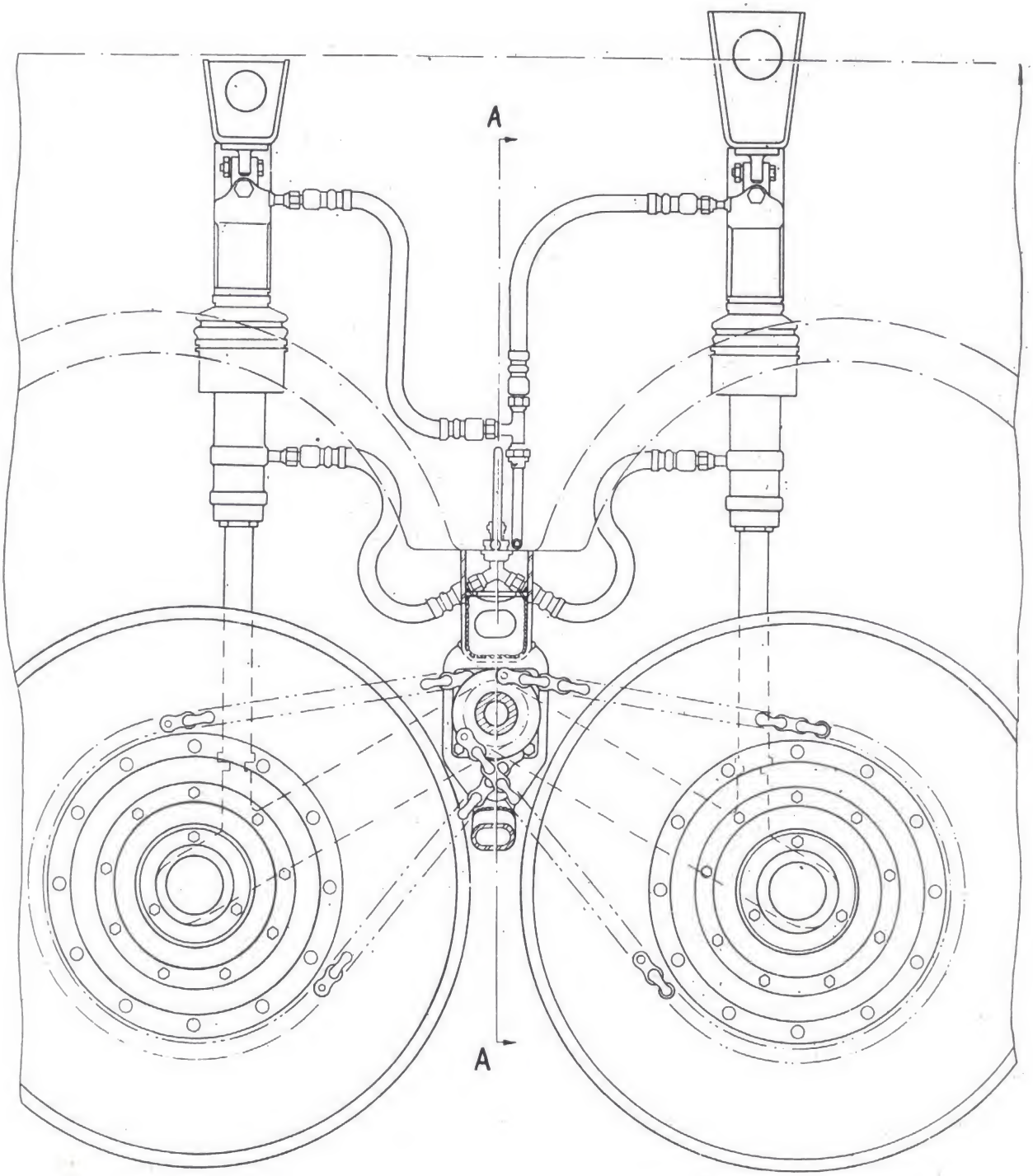
(a) visually check the condition of the auxiliary wheel drive chains. Make sure there are no foreign objects in the chains. Remove foreign objects, if any, from the chain links and from between the sprocket teeth and chains. Chains should tightly adjoin the sprocket teeth;

(b) visually check the auxiliary wheel tyres for condition. Replace damaged wheels when required;

(c) lubricate the rocker arm shafts and auxiliary wheel drive chains in case of operation of the vehicle on water.

2. During Preventive Maintenance No. 1, perform all operations under the Daily Maintenance and, in addition, check the tyre pressure in the auxiliary wheels; inflate the tyres to the normal value (5.5 to 6 kgf/cm^2), if required.

3. During Preventive Maintenance No. 2 perform all operations of Preventive Maintenance No. 1, and after 6000 km of run, in addition, check tightening of the propeller shaft flange nuts if the auxiliary wheels have been used.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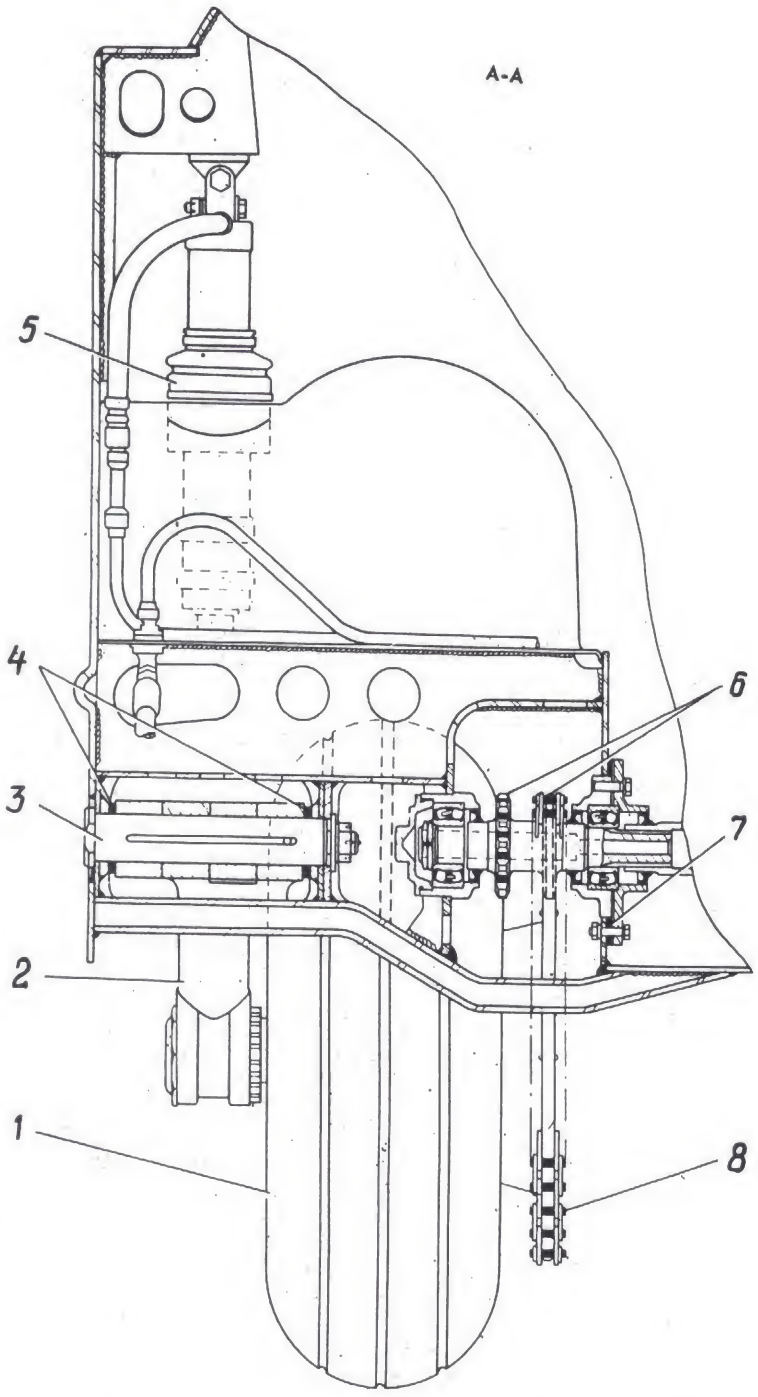


FIG. 68. AUXILIARY WHEELS SUSPENSION

1 – auxiliary wheel; 2 – rocker arm; 3 – rocker arm shaft; 4 – adjusting washers; 5 – hydraulic hoist; 6 – driving sprockets; 7 – adjusting shim; 8 – chain

4. After 15,000 km of run, perform operations specified in the scheduled maintenance and lubricate the auxiliary wheel hub bearings. Besides, lubricate the auxiliary wheels drive chains by boiling them in graphite grease. Prior to boiling, wash the chains in kerosene and dry them up. Then, immerse coiled chains in hot graphite grease (at a temperature of 70 to 80°C) for 5 min. Move the chains slightly for better penetration of grease into the chain links. After the lubrication, hang the chains to let excess of lubricant run off.

Chapter 7

WATER-JET PROPELLER AND WATER DISCHARGE EQUIPMENT

WATER-JET PROPELLER

The vehicle is propelled on water by the water-jet propeller located in the rear of the hull.

The water-jet propeller consists of an aluminium casing, propeller screw, reduction unit (installed inside the casing), shutter, and shutter control.

The water-jet propeller intake duct is integral with the vehicle hull and is formed by the stamped bottom plate and the rear axle bay. A grill welded in the inlet portion of the water jet intake duct protects the water-jet propeller from entry of foreign objects.

Fastened to the rear of the water-jet propeller casing is the diffuser which consists of two parts (upper and lower).

The machined flange of the water-jet propeller casing is secured through a rubber gasket to the vehicle hull, in a special bay.

The water-jet propeller reduction unit is arranged directly in the casing (Fig. 69) and consists of two pairs of bevel gears with a common gear ratio of 1.33.

The gear shafts rest in tapered bearings. The front end of the reduction unit primary shaft is provided with a flange for connection with the drive propeller shaft.

Four-blade propeller screw 15 is right-hand.

The bearings are lubricated with oil poured into the cavity of the water-jet propeller reduction unit. The oil level should be at the lower edge of the oil filler hole. Oil is drained through two drain holes. To prevent formation of air locks, the reduction unit is provided with an air vent which should be opened when pouring the oil. The oil filler hole, air vent and oil drain holes are closed with plugs.

The water-jet propeller bearings, backlash and gear contact are adjusted at the Manufacturing plant and, as a rule, require no adjustment during the operation. The adjustment is necessary only when some of the parts of the bearings are heavily worn or being replaced.

It is impermissible to take up the increased backlash in the water-jet propeller gears resulting from wear of teeth, by means of adjustment since it will disturb the mutual position of the run-in surfaces and will lead to step-up of noise or to breakage of the teeth.

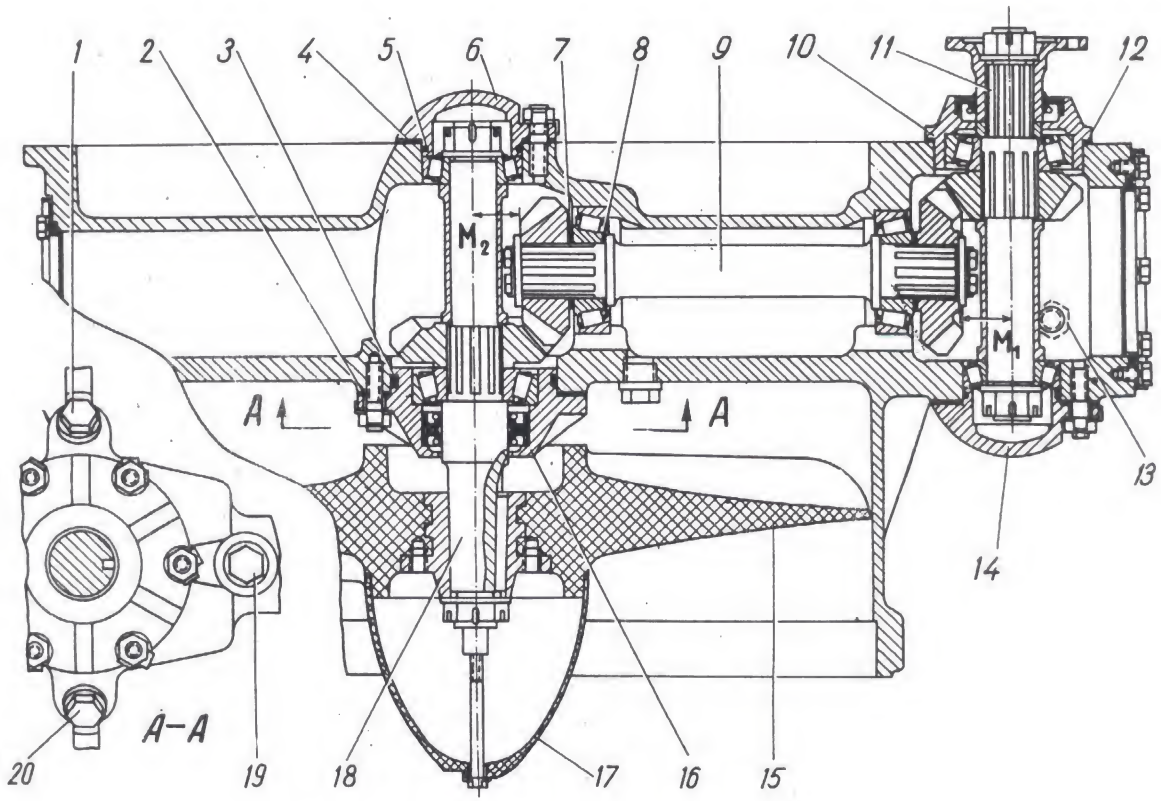


FIG. 69. WATER-JET PROPELLER

1 – air vent hole plug; 2, 4, 7, 8, 12 – adjusting shims; 3, 5 – sealing rings; 6, 16 – front and rear bearing caps of propeller screw shaft; 9 – intermediate shaft; 10, 14 – front and rear bearing caps of primary shaft; 11 – primary shaft; 13, 20 – drain plugs; 15 – propeller screw; 17 – propeller cone; 18 – propeller screw shaft; 19 – oil filler plug

The gear pairs are completed at the Manufacturing plant with respect to their backlash, contact and noise produced; therefore, they may be replaced only in pairs.

If the water-jet propeller has been disassembled, observe the following requirements in assembling it:

1. Water-jet propeller intermediate shaft 9 should rotate freely without axial play when its gears are tightened up. To this end, measure the clearance between the bearing inner races upon pressing-in the outer races of the intermediate shaft bearings and mounting the bearing inner races without the shaft for a while.

Subtract the distance between the intermediate shaft beads from the obtained value. The found difference will determine the thickness of the set of shims 8 required for proper tightening of the bearings. If it is impossible to measure, define the set of the shims by selection based on certain experience gained on assembly. Improperly selected set of shims may lead to breakage of the gears.

2. The intermediate shaft gears are installed in strict compliance with mounting sizes M_1 and M_2 equal to 33 mm, with the help of shims 7 placed under both the gears. If the hub thickness deviation is designated on the gear end face by sign "-" (minus), the gear is installed with mounting size 33 plus the indicated deviation. On the contrary, if the deviation is marked with sign "+" (plus), the gear is installed with size 33 less the deviation.

3. Shaft 18 of the propeller screw is assembled after the gears are mounted on the intermediate shaft. If the gears have not been replaced, the number of shims 2 under rear cap 16 must remain unchanged. In case of replacement of the gear pair

the gear of the propeller screw shaft is installed by making use of the contact pattern and backlash which must be 0.15 to 0.45 mm and must not vary for the given pair by more than 0.2 mm.

The backlash is adjusted by shims 2 placed under the rear cap. The bearing tightening is adjusted after adjusting backlash of the gear pair. The bearing adjustment is effected by using shims 4 placed under front cap 6.

The shaft should rotate freely, without axial play.

4. If no gears were replaced during installation of the primary shaft, the number of shims 12 under front cap 10 should remain unchanged.

When replacing the gear pair, the primary shaft gear is installed by making use of the contact pattern and backlash in the same way as in the case of the propeller screw shaft and with the same values. The adjusting shims are placed under the front cap.

After setting the required meshing, adjust tightening of the primary shaft bearings. The procedure is the same as for the propeller screw shaft bearings. The shaft must rotate freely without axial play.

The diffuser is closed with a shutter. On land, the shutter serves as armour protection for the water-jet propeller.

Mounted in the front of the vehicle is a splash panel which prevents flooding of the vehicle front during operation on water.

The water-jet propeller shutter and splash panel are controlled by the driver using the hydraulic valves (see Chapter 8).

WATER DISCHARGE EQUIPMENT

The water discharge equipment serves to remove water from the vehicle hull. It includes the water discharge system, by-pass valve, electric bilge pump and drain valves (kingston valves) used for water drainage on land. All these facilities operate independently from each other.

The water discharge system is the primary water-discharge means. Its principle of operation is rarefaction created in the water-jet propeller casing by operation of the propeller screw.

The water discharge system includes discharge valve 3 (Fig. 70) and its control, trough 4, inlet and outlet pipes, discharge branch pipe, and non-return valve 7.

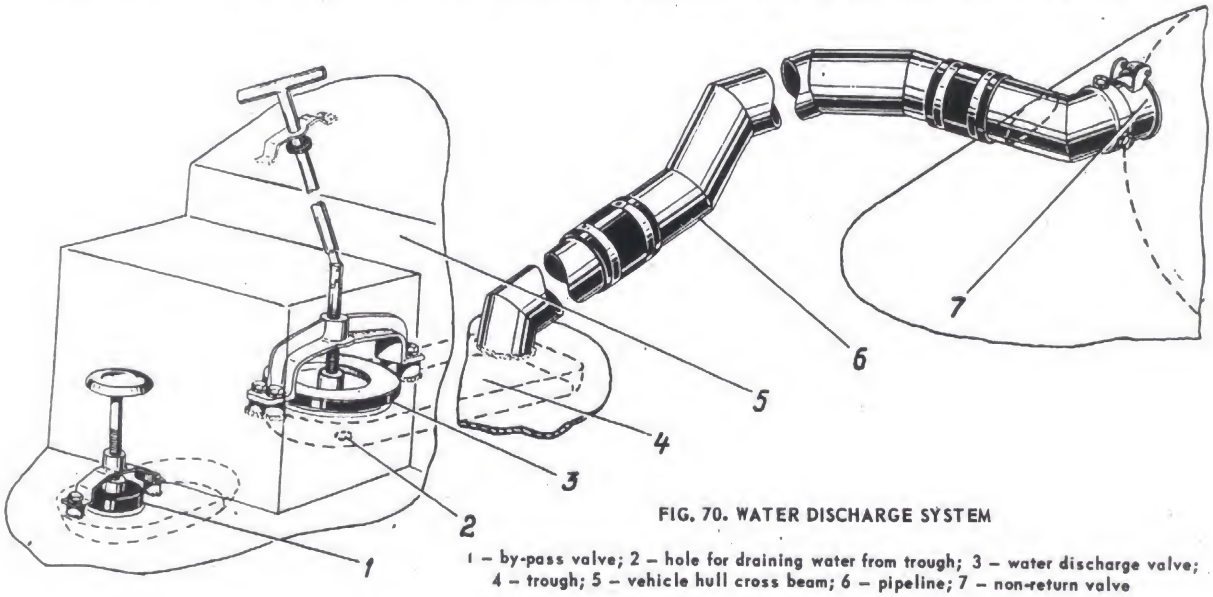


FIG. 70. WATER DISCHARGE SYSTEM

1 – by-pass valve; 2 – hole for draining water from trough; 3 – water discharge valve; 4 – trough; 5 – vehicle hull cross beam; 6 – pipeline; 7 – non-return valve

Water discharge valve 3 is located at the bottom of the engine compartment, closer to the vehicle right side. The valve control handle is painted red and is found in the fighting compartment protruding from the casing when the control handle is turned clockwise, the valve comes tight on the thrust ring and shuts the drain hole in the hull bottom. Trough 4 is welded under the drain hole. It has hole 2 for draining of remaining water when the vehicle is on land. The chamber formed by the hull bottom and trough 4 receives the welded-in inlet pipe which is connected to the water discharge branch pipe through rubber hoses and outlet pipe. The latter is welded in the cylindrical portion of the bottom plate in front of the water-jet propeller. Non-return valve 7 is installed on the discharge branch pipe end.

Welded to the bottom plate from below, just under the vehicle hull cross beam, in front of discharge valve 3 is another trough for by-passing water from the fighting compartment into the engine compartment. The vehicle bottom has special holes above the trough front and rear portions. The hole on the side of the fighting compartment is closed by by-pass valve 1.

When by-pass valve 1 is closed, water is drained through discharge valve 3 only from the engine compartment. Water discharge from the fighting compartment is effected when both valves 3 and 1 are open.

During operation of the vehicle, by-pass valve 1 should be kept open except for those cases when hermetic sealing of the fighting compartment is required.

Valve 3 should be opened only for the time required for draining water from the vehicle hull.

After draining water, immediately shut the valve. Remember, that delayed shutting of the valve results in air inleakage through the drain hole which leads to drop of the propeller screw thrust and increase in the engine speed. The increase in the engine speed may cause premature wear of the engine while the drop of the propeller screw thrust causes reduction of the vehicle speed on water.

Non-return valve 7 is designed to prevent flooding of the vehicle in emergency when water discharge valve 3 is accidentally left open and the water-jet propeller is inoperative. The non-return valve opens automatically only when the water-jet propeller functions. As soon as the propeller screw stops rotating, the valve plate closes the water discharge system outlet opening.

During operation of the vehicle, check condition of the discharge valve and the non-return valve; their seals should easily, without seizing come into their seats.

All joints of the water discharge system should be tight. Loose joints let air into the system and thus worsen functioning of the propeller screw. Besides, when the water-jet propeller is inoperative, loose joints let outboard water inside the vehicle.

The water drain valves (kingston valves) designed for draining water when the vehicle is on land are located as follows: one is located ahead of the front axle bay in front of the commander's seat and the other, behind the bay.

Valve support 2 (Fig. 71) is secured to the hull bottom. Screwed in the support is stem 1. Seal 3 is secured on the stem lower end while its upper end holds the knob. The seal tightly fits its seat in the vehicle hull bottom plate. The valve is opened by turning the knob counterclockwise and closed by turning it clockwise.

After draining of water from the vehicle hull, the valves must be closed. The valve knob is accessible through the hatch provided in the floor in front of the commander's seat and closed with a hinged cover.

The electric bilge pump is auxiliary water discharge means used when the water-jet propeller is inoperative.

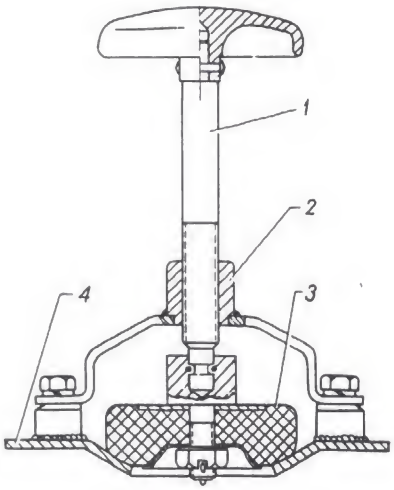


FIG. 71. WATER DRAIN VALVE (KINGSTON VALVE)

1 – valve stem; 2 – support; 3 – seal; 4 – seat

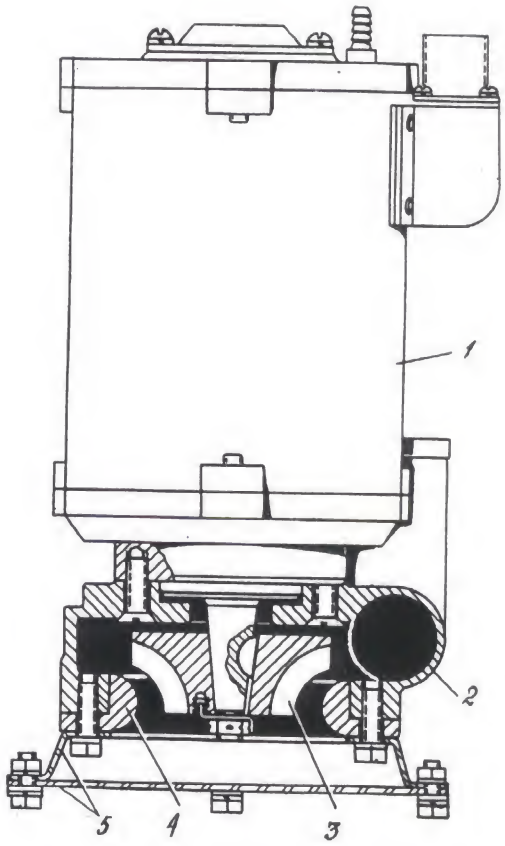


FIG. 72. ELECTRIC BILGE PUMP

1 – electric motor; 2 – pump body; 3 – impeller; 4 – cover; 5 – gauze

The pump gauze rests on the hull bottom and secured by a clamp to the bracket welded to the wall of the water-jet propeller casing. Water is pumped out of the hull through the pipe connected to the pump body volute neck by the hose.

The pump consists of electric motor 1 (Fig. 72), body 2, impeller 3 and cover 4.

The lower end of the pump is covered by gauze 5 (screen) which protects the pump from large-size solid objects that could wedge the pump impeller.

The pump electric motor is cut in by the switch located on the vehicle instrument panel.

Care of Water-Jet Propeller and Water Discharge Equipment

The following operations are performed during different types of maintenance.

1. Cleaning of the water-jet propeller intake duct and shutter cave of dirt, checking of the water-jet propeller shutter for full opening and tight closing and checking of the splash panel for hoisting and lowering (during Daily Maintenance).

2. Visual inspection of the propeller screw blades for good condition, checking of the propeller screw for proper fastening to its shaft, checking of the nuts securing the flanges of the propeller shafts of the water-jet propeller drive and their tightening, whenever necessary (during Preventive Maintenance No. 2).

3. Lubrication of the water-jet propeller shutter shaft and the rudder control universal joints (every 6000 km of the vehicle run).

4. Checking of the level of oil in the water-jet propeller casing and oil replenishment, if required (after 25 hours of operation on water).

5. Renewal of oil in the water-jet propeller casing and lubrication of the propeller shaft universal joints after 50 hours of operation on water.

6. Lubrication of the water discharge system valve screws (after 15,000 km of the vehicle run).

WARTER-JET PROPELLER AND WATER DISCHARGE EGUIPMENT TROUBLES AND REMEDIES

Symptom and Cause	Remedy
Speed of vehicle on water is low despite normal engine operating speed:	
(a) clogged intake duct grill:	Clean grill by engaging reverse gear in water-jet propeller power take-off
(b) open or insufficiently closed water discharge valve	Close valve or remedy its insufficient closing
Bilge pump motor operates but water remains in hull: clogged gauze	Clean gauze

Chapter 8

HYDRAULIC SYSTEM

GENERAL

The vehicle hydraulic system is used for hoisting and lowering of the auxiliary wheels, for operation of the steering booster, for lifting and lowering of the water-jet propeller shutter and the splash panel. Oil АМГ-10 is operating fluid of the s system.

The pump which is of a high-pressure, gear type serves for forcing fluid into the hydraulic system. It is flange-mounted on the water-jet propeller power take-off.

The pump consists of a body, cover and two gears with shafts. The gears rotate in roller (needle) bearings. The driving gear shaft end is square for coupling with the drive. Sealing of the pump housing where the driving gear shaft projects from the latter is ensured by two spring-loaded oil seals.

The filter is of a slotted type. Its filtering element is made of special shaped wire and is designed for cleaning the operating fluid of suspended solid particles. To clean the filtering element, use is made of a metal rod fitted with two scraper plates. A handle on the rod end is used to turn the rod. The filter housing bottom has a drain hole for draining the sludge.

The tank is used to compensate the difference in volume of the cylinders when the cylinder rods are inserted and extended. The tank is secured on the left side of the vehicle.

At the top, the tank is provided with a filler neck closed with a threaded plug. Installed in the filler neck is a gauze filter. Near the tank filler neck, a branch pipe is mounted which is connected with the drain pipe by the hose. The lower end of the branch pipe is brought inside the tank; it has several holes to split up the oil stream and prevent foaming.

Installed on the tank bottom is a branch pipe connected to the hydraulic pump inlet pipe by a hose.

The fluid level in the tank, when the auxiliary wheels are hoisted, should be 75 to 80 mm below the filler neck upper edge. When this is attained, the hydraulic tank filler plug will be screwed home.

The safety valve serves to protect the hydraulic system from excessively high pressure. It is connected to the hydraulic system in parallel and maintains the rated pressure in the system. When the pressure exceeds the rated value, the safety valve operates and starts by-passing the operating fluid through itself.

Control Valves

Two control valves are mounted on the front left-side wheel bay.

The front valve is used for lifting and lowering of the splash panel and the water-jet propeller shutter, and the rear valve, for hoisting and lowering of the auxiliary wheels. When the hydraulic pump supplies the steering booster, the valve handles should be in the neutral position i.e. turned upwards and set in position STEERING WHEEL (РУЛЬ).

To open the water-jet propeller shutter and to lift the splash panel, the front valve handle should be turned forward. To close the shutter and to lower the splash panel, this handle should be turned towards the vehicle rear.

To lower the auxiliary wheels, the rear valve handle should be turned rearward, and to hoist the auxiliary wheel, forward.

As soon as hoisting or lowering of the auxiliary wheels (lifting or lowering of the splash panel and opening or closing of the water jet propeller shutter) is completed, the valve handles should be swiftly turned to the neutral position (position STEERING WHEEL). Bear in mind that duration of any of the above operations is 25 to 30 s.

Operation of Auxiliary Wheels Hydraulic System

Hoisting and lowering of the auxiliary wheels is effected through delivery of the operating fluid either into the upper or into the lower chambers of the hydraulic hoist which is actually cylinder 1 (Fig. 73) inside which rod 4 with piston 2 goes up or down.

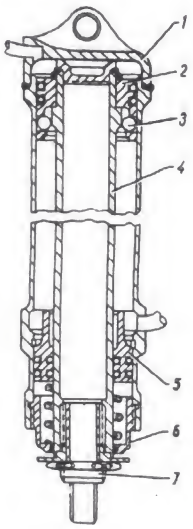


FIG. 73. HYDRAULIC HOIST

1 – cylinder; 2 – piston; 3 – lock ball; 4 – rod; 5 – lock piston; 6 – cylinder bottom; 7 – end piece

The cylinder is secured to the vehicle hull and the rod, to the auxiliary wheel rocker arm. Pipe unions for delivery of the operating fluid are provided in the upper and lower parts of the cylinder. The rod is held in the extended position by the lock installed inside the cylinder.

To unlock the rod, the operating fluid should be pumped into the lower chamber of the cylinder.

To lower the auxiliary wheels into the operating position, proceed as follows.

Start the engine if it is not running.

Shift the auxiliary wheels control valve handle to the rearmost position (towards the vehicle rear). In this case, the control valve will operate for lowering the auxiliary wheels, and pump 7 (Fig. 74) will start sucking fluid from hydraulic system tank 6 and pump it into the main. From the pump, the operating fluid is forced via filter 8, safety valve 9 and pipes to control valves 12 and 13.

The slide valve in the auxiliary wheels control valve housing will assume the position when fluid is delivered along the pipes into the upper chambers of the hydraulic hoists. Due to the fluid pressure, the pistons will go down.

The fluid contained in the lower chambers of the hydraulic hoists will be drained through the control valve into the hydraulic system tank. As the hydraulic hoist pistons reach the lowermost position, their balls will thrust against the end face of the lock pistons. The pistons will compress the springs under the lock pistons, and the pistons will move downward until the piston balls get into the circular grooves of the cylinders.

After the balls get into the circular grooves, the lock pistons pressed by their springs will occupy the initial position, thus locking the piston balls in the cylinder circular grooves. The hoist cylinder pistons and their rods will be fixed in this position. Entry of the balls in the hoist cylinder circular grooves is accompanied by clicks. After clicking in all the hydraulic hoists, the control valve should be set in the neutral position.

To hoist the auxiliary wheels, shift the auxiliary wheels control valve handle to the foremost position.

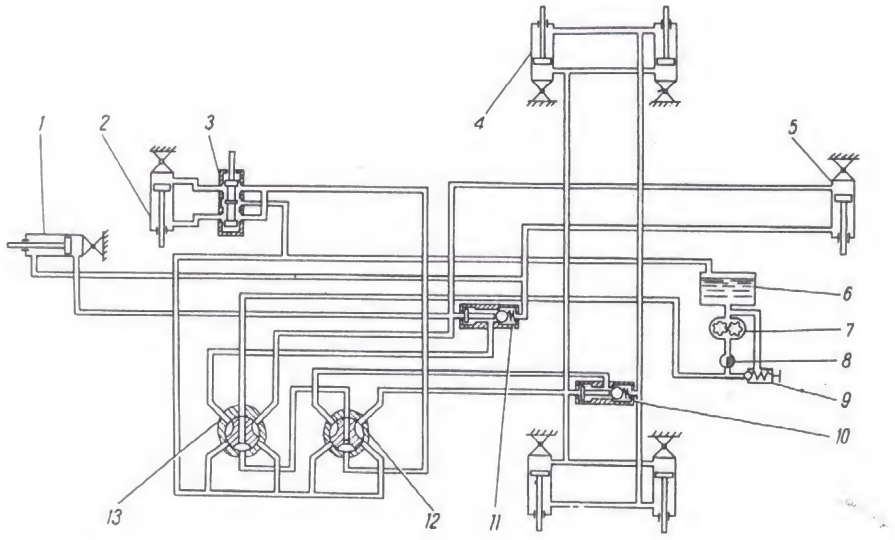


FIG. 74. SCHEMATIC DIAGRAM OF HYDRAULIC SYSTEM

1 – splash panel hydraulic hoist; 2 – steering booster cylinder; 3 – steering booster control valve; 4 – auxiliary wheel hoists (4 pcs); 5 – water-jet propeller shutter hoist; 6 – tank; 7 – pump; 8 – filter; 9 – safety valve; 10 – auxiliary wheels hydraulic lock; 11 – splash panel and water-jet propeller shutter hydraulic lock; 12 – auxiliary wheels control cock; 13 – splash panel and water-jet propeller shutter control cock

As a result, operating fluid is delivered from the pump through filter 8 and safety valve 9 into the control valve and further through pipes into the cavity under the cylinder piston in hydraulic hoist 4. Due to pressure of the operating fluid, the springs under the lock pistons will get compressed and the lock pistons will move downward until the balls of the hydraulic hoist pistons become unlocked. As soon as the balls are unlocked the pistons with the rods will move up due to the heavy pressure of the fluid bring the balls out of the cylinder circular grooves, and lift the auxiliary wheels.

Pressed by the springs, the lock pistons will return to their initial position. The fluid in the cylinders above pistons is forced out through pipes into control valve 12 and further through the pipe into hydraulic system tank 6.

With the pump still operating and the control valve remaining in the same position, a very high pressure may be build in the main. As the pressure reaches 120 kgf/cm^2, the spring of safety valve 9 will be compressed and the valve will open. In this case the operating fluid will pass through the safety valve straight into the drain line of the valve.

WARNING! In case of long-term storage, the vehicle auxiliary wheels should be lowered. In the event of failure of the hydraulic system units, its components must be repaired in the repair shops.

Operation of Splash Panel and Water-Jet Propeller Shutter Hydraulic System and Adjustment of Their Hydraulic Control

The splash panel and water-jet propeller shutter have hydraulic controls which are interlocked and controlled by one valve. The water-jet propeller shutter opens simultaneously with lifting the splash panel and closes when the splash panel is being lowered.

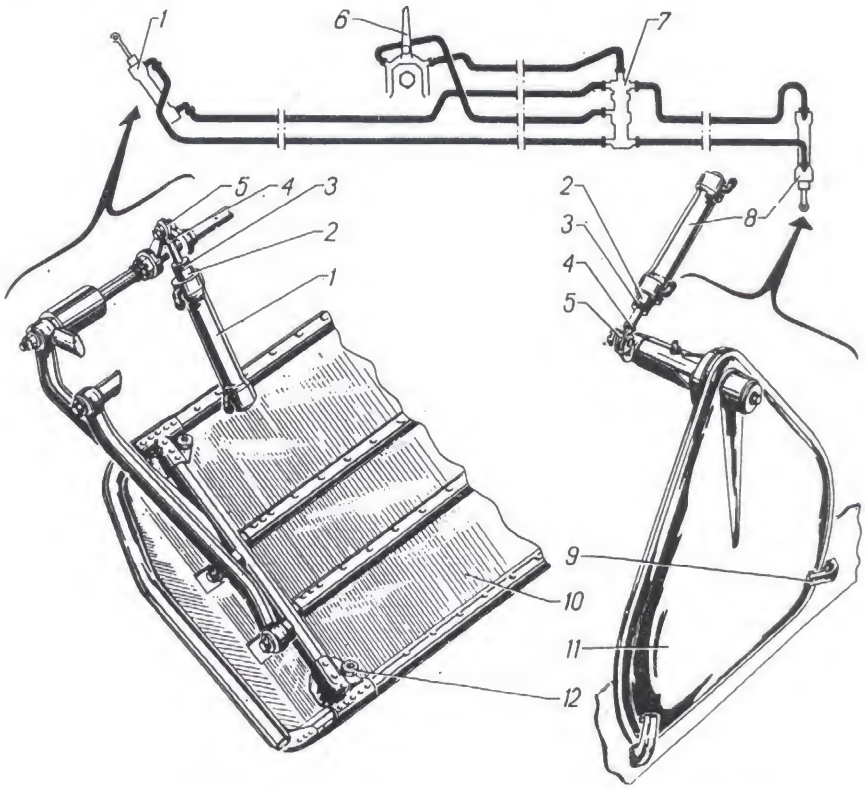


FIG. 75. SPLASH PANEL AND WATER-JET PROPELLER SHUTTER HYDRAULIC CONTROL

1 – splash panel control cylinder; 2 – bush; 3 – adjusting washers; 4 – lock nut; 5 – cylinder rod bolt; 6 – splash panel and water-jet propeller shutter control cock; 7 – hydraulic lock; 8 – water-jet propeller shutter control cylinder; 9 – water-jet propeller shutter stop; 10 – splash panel; 11 – water-jet propeller shutter; 12 – splash panel buffer

Splash panel 10 (Fig. 75) and water-jet propeller shutter 11 are lifted and lowered by hydraulic cylinders 1 and 8 which are similar in design. When the splash panel is lowered and the water-jet propeller shutter is closed, rods 7 (Fig. 76) of the cylinders are fully extended, fixed in position and retained by ball locks 6.

When in the lowered position, the splash panel is pressed to the hull front plate with rubber buffers 12 (see Fig. 75), and water-jet propeller shutter 11 thrusts against stop 9. Pressing force is adjusted by making use of bolts 5 of the rods of cylinders 1 and 8. The force is increased by screwing off the bolt and decreased by screwing it in. The pressing force should be adjusted so as to avoid warping of the control components.

To regulate the pressing force, proceed as follows:

1. Unscrew lock nut 11 (Fig. 76) of hydraulic cylinder rod bolt 12.
2. Screw in or off rod bolt 12 to the required amount.
3. Screw on lock nut 11.

The hydraulic cylinder rod travel required for lifting the splash panel and opening the water-jet propeller shutter is adjusted by means of shim washers 10.

With the splash panel lifted and the water-jet propeller shutter opened, the hydraulic cylinder rods are fully inserted and fixed in position by the fluid held by the hydraulic lock.

In this case, rod lock nut 11 must thrust against shim washers 10, and the splash panel lift arms should be pressed to the hull stops.

When open, the water-jet propeller shutter should not overlap the water-jet propeller outlet opening, but at the same time the distance between the shutter edge and the edge of the outlet opening in the hull rear plate must not exceed 25 mm.

The splash panel will be pressed to the hull front plate and the water-jet propeller shutter will not swing on its shaft and strike against the hull when the vehicle runs on land only if the hydraulic drive is properly adjusted.

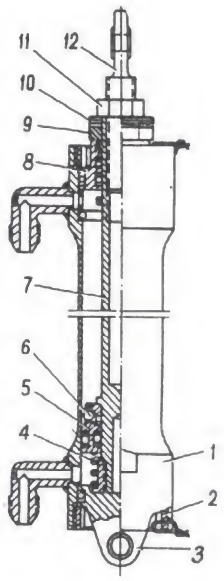


FIG. 76. WATER-JET PROPELLER SHUTTER CONTROL CYLINDER

1 – cylinder housing; 2 – cover nut; 3 – cover; 4 – spring; 5 – piston; 6 – ball lock; 7 – rod; 8 – oil seal cover; 9 – bush; 10 – shim washers; 11 – lock nut; 12 – rod bolt

Care of Hydraulic System

The following operations are performed during different types of maintenance.

1. Checking of the system pipe joints for leakage of working fluid (during Daily Maintenance).

2. Checking and replenishment, if necessary, of operating fluid in the hydraulic system tank (during Preventive Maintenance No. 2).

3. Checking of the pump fastening nuts for tightening and turning of the hydraulic system filter knob until 25 to 30 clicks are heard (during Preventive Maintenance No. 2 every 6000 km of run).

Chapter 9

ELECTRICAL EQUIPMENT

GENERAL

The vehicle electrical equipment (except for horn and inspection lamp) employs a
e-wire circuit.
The electrical equipment consists of power source and power consumers, checking
easuring instruments, auxiliary equipment, switching equipment, protective de-
, connecting elements and wires.
The negative terminals of the power sources and those of the power consumers are
cted to the vehicle hull.
The power sources include the storage battery and generator operating in parallel
the storage battery in conjunction with the generator regulator.
The power consumers include the starter, illumination devices, horn, ignition
es, vision devices, radio station, navigational equipment, electric motors (of
r-ventilator unit, windshield wiper, bilge pump, heater, windshield defroster,
ing preheater, drive of air inlet and outlet doors), etc.
The auxiliary equipment includes the instrument panel, board of inspection lamp
t, etc.
The switching equipment and protective equipment include the battery switch,
e-over switches, protective devices, circuit breakers, switches and button
nes.
The checking and measuring instruments include the voltammeter, temperature
s, pressure gauges, tank fuel level indicator, speedometer, sensing units, etc.
The connecting elements
de junction boxes, junction
s, plug connectors.
The mains rated value is 24 V.
The key diagram of the elec-
l equipment is given in Fig. 77.

STORAGE BATTERY

The vehicle is equipped with
/ lead-acid storage battery.
attery is mounted on the left
of the engine compartment.
The storage battery must be
ly secured in its seat. To

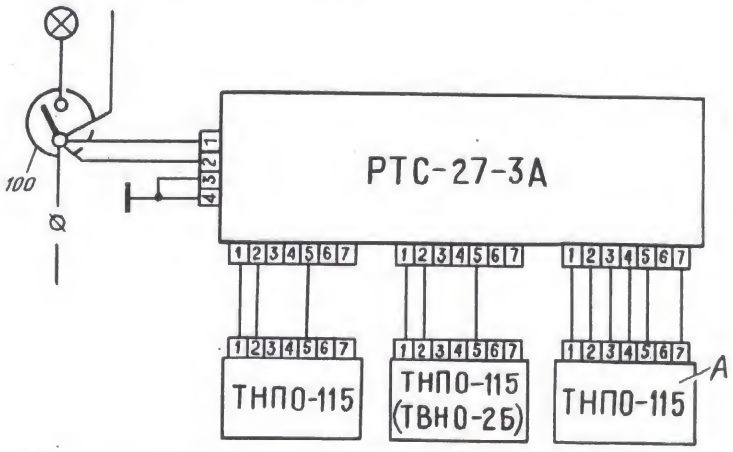


FIG. 78. CONNECTION DIAGRAM OF VISION DEVICES ТНПО-115 AND ТВНО-2Б
A – main device ТНПО-115

keep the battery in good condition, it is necessary to strictly follow the requirements specified in the operating and maintenance instructions on the storage battery which are supplied with the vehicle.

If the engine runs idle for more than 5 minutes, adjust the crankshaft speed for the minimum value which ensures recharging of the storage battery. The speed is adjusted by means of the throttle knob.

To check the storage battery for condition on the vehicle, proceed as follows.

1. Press the voltammeter button without turning on the battery switch. In this case, all the power consumers must be cut off.

The voltammeter must read zero. Deviation of the pointer is indicative of current leakage (the most probable cause of current leakage is that the surface of the battery is dirty).

2. Turn on the battery switch, press the voltammeter button and measure the battery EMF. The voltmeter must read not less than 24 V.

The voltmeter reading below 24 V is an indication of a fault or discharge in the battery. Check each cell in this case with a battery cell tester.

3. The level of electrolyte in the storage battery must be 10-12 mm above the baffle plate.

Check the level of electrolyte with a glass pipe, dia. 3 to 5 mm. To do this, immerse the pipe into electrolyte until it thrusts against the baffle plate located above the separators, close the pipe upper end hole with the forefinger, lift the pipe and determine the level of electrolyte in the cell by the electrolyte level in the pipe. In case the level of electrolyte is below the normal one, replenish the cell with distilled water. It is permissible to add electrolyte only in case it is known that the level of electrolyte dropped because of splashing out or leakage.

Bear in mind that at low temperatures the storage battery capacity decreases approximately 1 or 2 per cent per each degree of electrolyte temperature drop as compared with the normal temperature (25 to 30°C). Permissible discharge of the battery is 25 per cent, maximum, in winter and 50 per cent, maximum, in summer (reduction of electrolyte specific gravity by 0.01 gf/cm^3 corresponds to the 5 or 6 per cent battery discharge).

4. Start the engine and set the moderate speed. After 10 to 15 minutes of operation, check the magnitude of charging current. With the sound and fully charged storage battery, the charging current is so low that the ammeter reading approaches zero.

Battery Switch

The battery switch permits disconnection of the storage battery from the entire vehicle electrical system (with the exception of the inspection lamp socket) without disconnecting the cables directly from the battery terminals. This is accomplished by breaking the circuit between the battery negative terminal and the vehicle hull.

The battery switch is mounted on the left-hand bulkhead between the engine and fighting compartments. The hand-operated battery switch (Fig. 79) has cut-in knob 2 and cut-out knob 1. When depressed, knob 2 closes the battery circuit which is broken by pressing knob 1.

When the vehicle is at halt or when preventive maintenance operations are carried out, the battery should be cut out.

GENERATOR

The vehicle employs an ac generator with a built-in rectifier.

The generator is actuated by two V-belts driven by the engine crankshaft pulley. Tension of the belts is adjusted by turning the generator relative to the lower attachment bolts which should be loosened by means of the brace. When applying an effort of approximately 4 kgf to each belt, its deflection must be 11 to 13 mm.

If one of the belts fails, replace the whole set of belts (on the spares set the generator drive belts are delivered as a complete set only, with the difference in length is not over 3 mm).

Within 30,000 km of run the generator requires neither lubrication nor additional adjustment. When washing the vehicle, keep the generator clear of water.

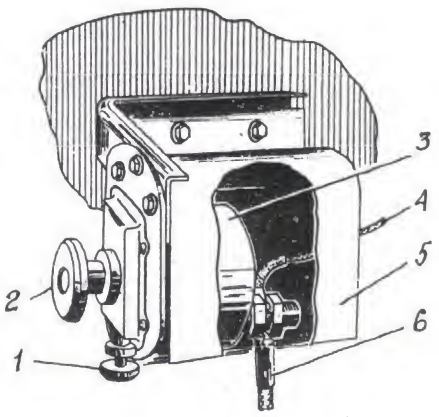


FIG. 79. BATTERY SWITCH

1 – ground cut-out knob; 2 – cut-in knob 3 – battery switch; 4 – cable to connector socket; 5 – protective plate; 6 – wire from storage battery negative terminal

GENERATOR REGULATOR

The generator operates together with the generator regulator. The generator regulator key diagram is given in Fig. 80.

The generator regulator provides a means for:

1. Connection (disconnection) of the generator field winding circuit to (from) the vehicle mains when turning on (off) the ignition switch.

2. Maintaining automatically the generator voltage within the preset range under all probable variations of the generator rotor speed, load current, and temperature.

3. Automatic protection of the generator against overloading (current limiting).

4. Automatic disconnection of the starter after starting the engine and keeping the starter circuit disconnected within the entire engine speed range.

5. Automatic protection of the regulator output control element, i.e. the semiconductor triode (transistor) against accidental short-circuiting in the generator field winding circuit.

MAIN CHARACTERISTICS OF GENERATOR REGULATOR PP361A

Characteristics	Unit of measurement	Rated value
Cut-in voltage of field winding circuit switching relay	V	11-15
Cut-in voltage of starter relay	V	11-15
Protective relay must operate in emergency mode whether generator regulator is cold or hot	-	When shunt circuit is shorted to ground
Range of controlled voltage at +20°C, 3350 to 3650 r/min and load current of 60 A	V	26.5-28.0
Range of controlled voltage with generator rotor speed varying from 2500 to 6500 r/min and load current varying from 10 A to 110 A, generator regulator and generator being cold or hot	V	26.5-28.5
Current limiting range	A	115-128
Cut-in voltage of starter interlocking relay	V	11-13
Cut-off voltage of starter interlocking relay	V	5, max

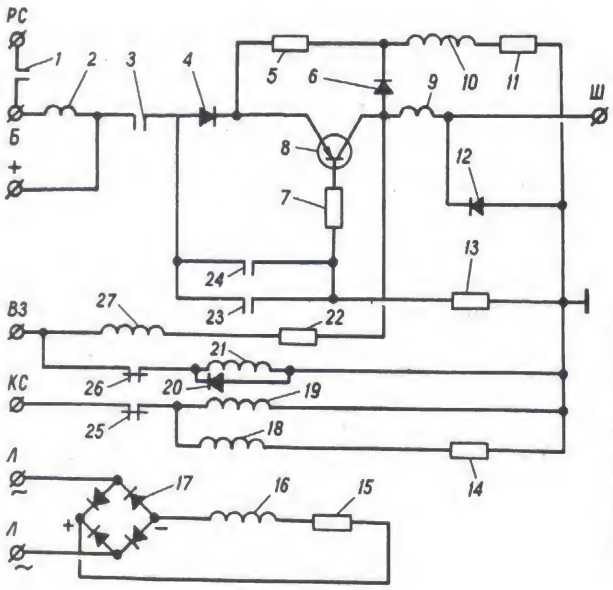


FIG. 80. GENERATOR REGULATOR PP361A. KEY DIAGRAM

1 – starter relay contacts; 2 – overcurrent relay series winding; 3 – contacts of switching relay; 4 – diode Д242; 5 – resistor, 2.4 ohms; 6 – diode Д202; 7 – resistor, 3 ohms; 8 – transistor П217; 9 – protective relay series winding; 10 – voltage regulator shunt winding; 11 – resistor, 3.5 ohms; 12 – diode Д242; 13 – resistor, 80 ohms; 14 – resistor, 24 ohms; 15 – resistor, 17 ohms; 16 – interlocking relay primary winding; 17 – diodes Д202; 18 – interlocking relay accelerating winding; 19 – starter relay shunt winding; 20 – diode Д7Б; 21 – switching relay shunt winding; 22 – resistor, 80 ohms; 23 – overcurrent relay contacts; 24 – voltage regulator contacts; 25 – interlocking relay contacts; 26 – protective relay contacts; 27 – protective relay shunt winding

STARTER

The starter is essentially a four-pole series-wound motor with a solenoid switch. The solenoid switch forces the starter pinion in engagement with the flywheel gear rim and closes the starter electrical circuit contacts. Disengagement is effected by the return spring after the solenoid switch ceases to operate.

The solenoid switch is actuated by a special starter relay located in the generator regulator. The starter relay is cut in by depressing the push-button switch located on the instrument panel.

The starter is protected against racing by a free-wheeling clutch and by interlocking the starter relay with the generator. After starting the engine the starter button must be immediately released. Continuous operation of the starter must be not more than 5 s long. If erratic firing takes place in the engine cylinders, continuous operation of the starter for 10 to 15 s is permissible. New switching of the starter may be attempted only after complete stopping of the engine and at least 10 to 15 sec after previous switching.

Principle Operating and Care Instructions for Storage Battery, Generator, Generator Regulator and Starter

1. Connect and disconnect the generator cables carefully so that the shield braiding is not shorted to the current-carrying core.

2. Do not start the engine if the positive wire running from the generator to generator regulator is disconnected. Never disconnect the positive wire from the generator regulator and generator terminals when the engine is running.

3. Never connect the generator and generator regulator terminals to the hull even for a short while for the purpose of sparking check. That will lead to damage to the generator regulator and generator.

4. Do not open the housing of the generator regulator in the course of operation.

Never adjust any of the generator regulator elements directly in the vehicle. If a defect is disclosed, send the generator regulator to a repair shop.

5. If the ammeter pointer is at zero or indicates insignificant charging current it is possible that the battery is fully charged. Unless the controlled voltage is checked, do not make conclusions that the system is defective.

Maintenance includes the following operations to be performed:

During Daily Maintenance:

(a) check the storage battery for proper fastening and clean it of dust and dirt;

(b) check the generator regulator for proper operation. To this end, start the engine, set the speed which ensures the storage battery recharging and check the mains voltage by depressing button 19 (see Fig. 93). It should be within 26.5 to 28.5 V. If with the engine running the voltage differs from the above-mentioned values it will indicate the generator failure;

(c) check the generator drive belts for tension and adjust it, if required.

During the Daily Maintenance perform this operation only in the course of the first 1000 km of run of the vehicle, and further, during Preventive Maintenance No.1.

During Preventive Maintenance No. 1 perform operations of the Daily Maintenance, and, in addition, do the following:

(a) check the level of electrolyte in the storage battery and add distilled water, if necessary;

(b) check the wire lugs for reliable fastening on the battery terminals;

(c) check the generator drive belts for tension, and adjust it, if required;

(d) check the all electric wiring contacts for condition and all the connectors for condition of cottering.

During Preventive Maintenance No. 2 perform the operations of Preventive Maintenance No. 1, and, in addition, proceed as follows:

(a) determine the state of charge of the storage battery according to the electrolyte specific gravity. If discharge of the storage battery is above the permissible value, remove the storage battery from the vehicle and send it for recharging;

(b) clean the generator, starter and generator regulator of dust and dirt. In this case the generator protective band may be removed. Dust and dirt should be removed with the aid of a brush or by blowing with compressed air. It is prohibited to use hard objects for cleaning purposes;

(c) check the generator regulator, starter, generator and its pulley for fastening; check the securing of wire contacts to the starter terminals.

WARNING! All operations mentioned above should be performed with the storage battery disconnected and the engine not running.

Every 6000 km of run, but at least once a year, do the following:

1. Remove the starter and check it for serviceability. When doing this, examine the uncovered portion of the shaft and manually check the drive for easy motion. In case of impeded motion due to dirt or thickened lubricant, clean the shaft of old lubricant with a clean rag moistened in gasoline and lubricate the shaft with clean motor oil. This done, check the drive shaft again to make sure it moves easily.

2. Check the coupling studs for tightening and tighten up, if required.

3. Reinstall the starter, reliably secure it with bolts and connect wiring.

Every 15,000 km of the vehicle run, it is necessary to perform preventive inspection and repair of the starter following the procedure below:

1. Remove the starter from the engine.

2. Loosen the tightening-up screw of the protective band from the frame. Check the brush assembly for condition. In this case:

(a) brushes should move in brush holders freely, without seizing and should not be excessively worn. Replace the brushes worn up to 6 or 7 mm in height;

(b) check the tightening of the screws securing the lugs of the brush pigtails and tighten them, if necessary;

(c) the commutator working surface should be smooth, without considerable burning. In case of contamination or burning, wipe the commutator with clean waste moistened in gasoline.

In case of failure to remove dirt or carbon deposit, grind the commutator with fine-grained sandpaper. If now carbon deposit is not removed, send the starter for repair.

3. Check the starter relay contacts for condition, thoroughly clean the contact box of dust.

If the contact bolts are considerably worn at points of contact with a contact disk, turn them through 180°.

4. Check the gap between the gear and the thrust ring.

The gap between the gear and the thrust ring should be within 2.5 ± 1 mm with the relay plunger fully pulled in and with the plunger play taken up to the commutator side.

5. Blow the starter with air to remove dust. In case of heavy contamination of the starter inner cavity, disassemble and thoroughly clean the starter.

WARNING! Clean the starter covers and drive of dirt with the aid of clean waste moistened in gasoline. Do not wash them in a dish with gasoline (kerosene) in order not to wash out lubricant from the bearings.

6. Assemble the starter, check it for serviceability (in the shop) and install it on the engine.

ENGINE IGNITION SYSTEM

The engine ignition system is of a battery, shielded type. The ignition system includes the distributor, ignition coil, ignition switch, voltage divider, spark plugs, high-tension wiring with suppressor resistors and low-tension wiring.

Trouble-free operation of the ignition system is ensured by:

1. Normal air gap between the breaker points and cleanliness of their surfaces.
2. Cleanliness of plastic parts and spark plugs and normal spark plug electrode gap.
3. Reliable connection of current conductors with terminals.
4. Serviceable carrent sources.
5. Sound capacitor in ignition distributor.

While washing the vehicle, keep the ignition system elements clear of water, otherwise it may cause difficulties in starting the engine or misfire.

The voltage divider serves for reducing the voltage supplied to the distributor and the ignition coil in the 24-V electrical equipment system in order to provide operating conditions of the ignition devices similar to conditions of their operation in the 12-V system. The voltage divider consists of three series-connected resistors R1, R2 and R3 (Fig. 82) mounted in a metal case.

The voltage divider is mounted in the front portion of the RH side of the hull. During operation the voltage divider will be heated up to 120°C, so never pile anything close to it, or cooling air flow will be blocked.

The ignition coil shielded, type operates together with the voltage divider. To ensure trouble-free operation of the ignition coil, observe the following requirements:

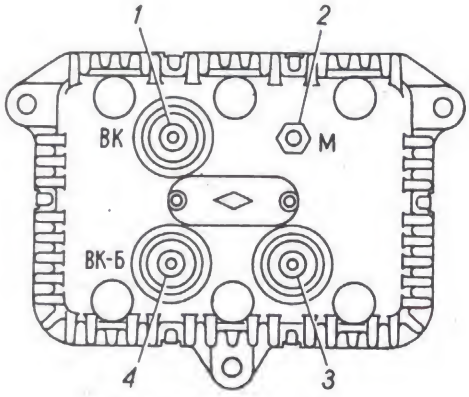


FIG. 81. VOLTAGE DIVIDER

1 – terminal for starter button switch cable; 2 – terminal for grounding wire; 3 – terminal for ignition coil cable; 4 – terminal for starter button switch and storage battery cables

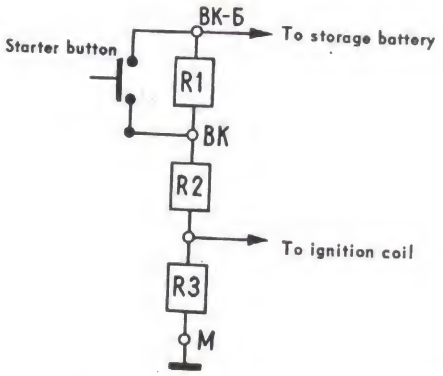


FIG. 82. VOLTAGE DIVIDER CONNECTIONS DIAGRAM

(a) do not keep the ignition system cut in longer than it is necessary for the engine operation;

(b) keep the ignition coil casing away from water;

(c) regularly clean the ignition coil of dirt and dust;

(d) protect the coil against mechanical damage;

(e) pay particular attention to the high-tension wire; make sure its lug is inserted into the ignition coil socket up to the stop, otherwise insufficient insertion will lead to break-down or burning-through of the coil cap.

To disconnect the high-tension wire from the ignition coil, unscrew nut 1 (Fig. 83) of the high-tension wire shielded hose on the ignition coil, unscrew union 2 and pull the wire out of seat 3 of the ignition coil cap.

To install the high-tension wire in the ignition coil cap seat, proceed as follows:

(a) install union 2 at a distance of at least 61.5 mm from the wire end, fix the union with rings 5 on both sides;

(b) insert wire 4 into ignition coil cap seat 3 and screw in union 2 with the wrench as far as it will go;

(c) tighten up nut 1 on union 2.

Spark plugs. The engine is equipped with spark plugs, type A11. These spark plugs ensure reliable operation of the engine under all conditions. Using of spark plugs of other types will cause abnormal operation of the engine.

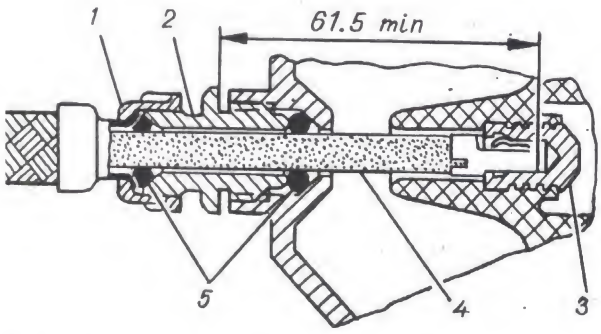


FIG. 83. INSTALLATION OF WIRE IN IGNITION COIL CAP SEAT

1 – nut; 2 – union; 3 – seat; 4 – wire; 5 – packing rings

When carrying out Preventive Maintenance No. 2, every 6000 km of run, turn out the spark plugs, check the electrodes for condition and gap. If required, clean the electrodes and adjust the gap.

The gap between the spark plug electrodes should normally be 0.8 to 0.9 mm. It is advisable to check the spark plug gap with a round wire feeler gauge available in the driver's tool kit (Fig. 84). When adjusting the gap, bend only the side electrode since any attempt of bending the central electrode will result in breakage of the spark plug insulator.

General Instructions on Distributor Maintenance

1. Protect the distributor from damage and keep it always clean (both on the outside and inside); see that no dirt, water and oil get inside the distributor.

2. Do not let connections of high-tension and low-tension wires become loose. Pay particular attention to reliable contact of the high-tension wire running from the ignition coil to the distributor.

3. See that the distributor-to-engine attachment screw and the octane selector plate nuts are not loose.

4. Periodically examine the distributor cam and breaker point surfaces. Oil or dirt should be removed from the distributor cam with a piece of dry and clean cloth, and the breaker points should be cleaned with a piece of cloth soaked in clean gasoline. After cleaning the points, draw off the breaker lever, let the gasoline evaporize, and then wipe the breaker points with a dry cloth. See that no fibers are left on them.

5. Periodically measure the gap between the breaker points using a feeler gauge (the gap should be 0.3 to 0.4 mm).

Before checking the breaker point gap, crank the engine crankshaft with the crank handle so as to set the breaker cam into the position of maximum separation of breaker points. To change the gap, loosen screw 9 (Fig. 85) that secures the plate with the breaker fixed point and adjust the required gap by turning screw 7 and using a feeler gauge. After adjustment, tighten up screw 9.

The check ignition timing for correct adjustment with the vehicle in motion since the timing adjustment is inevitably disturbed when adjusting the breaker point gap (see Section "Spark Timing").

6. Cleaning of breaker points 10 should be performed only in case their condition causes interruptions in operation of the ignition system (i.e. when the points are severely burnt or when a pimple is formed on one point and a pit on the other). Excessive cleaning is detrimental to the points.

Cleaning of points should be performed in the repair shop on a fine grinding stone after removal of the breaker lever and support from the distributor.

While cleaning the points, grind off only the pimple on one point and slightly smooth the other point surface. If it is not necessary to smooth out the pit completely.

After cleaning, remove metallic and abrasive dust, wipe the points with a piece of cloth soaked in clean gasoline, check the gap and adjust it, if required.

The breaker long-term and reliable operation is ensured only in case its points are strictly parallel and mating throughout the contact area.

Burnt portions of tungsten points are extremely hard. When en route, cleaning of points can be performed with a special needle file available in the driver's tool kit, or with a thin (about 1 mm) piece of abrasive grinding wheel. In this case it is necessary to slightly clean the point surface (without grinding off the pimple) so as to ensure engine operation until the vehicle arrives at a station where conditions permit to clean the points in the way described above.

Never make use of coins for cleaning the points since the coin metal remaining on the point surfaces may soon lead to the premature burning.

7. Timely lubricate all the distributor friction parts in compliance with the vehicle maintenance instructions. Never lubricate the distributor with dirty oil taken from the engine crankcase, for example, with the oil from the dipstick. Abundant lub-

rication is harmful since it can cause premature burning and undue wear of the breaker points.

8. After lubricating breaker lever axle 8, make sure the lever is free to turn on the axle without any seizing. To this end, depress and release the lever. When released, the lever must quickly return to its initial position due to the action of the spring, and the breaker points must close with a click.

If the points close not quickly or fail to close at all, eliminate the cause of seizing and adjust the breaker spring tension which must be 0.5 to 0.65 kgf.

The spring tension is adjusted through bending the spring free end towards the side required after removing the lever from the distributor.

9. After 15,000 km of run it is necessary to perform the following operations:

(a) remove the cap and wires, rotor, plate and points;

(b) wash and wipe all parts with a clean cloth soaked in gasoline;

(c) clean the breaker points by the method described above. Upon cleaning, wash and wipe the points with a clean cloth;

(d) remove wick from the holder, carefully cut off hardened scale on the wick ends, clean the wick of dust and dirt and mount it in the holder. Upon assembling the distributor, the wick ends should touch the cam. Drip two or three drops of engine oil to the wick;

(e) inspect the centrifugal regulator parts and make sure that they are serviceable;

(f) coat the cam with lubricant ЦИАТИМ-201;

(g) pack the cap of the oil fitting for oiling the shaft with lubricant ЦИАТИМ-201, place the cap home and lubricate the shaft;

(h) assemble the distributor in whole;

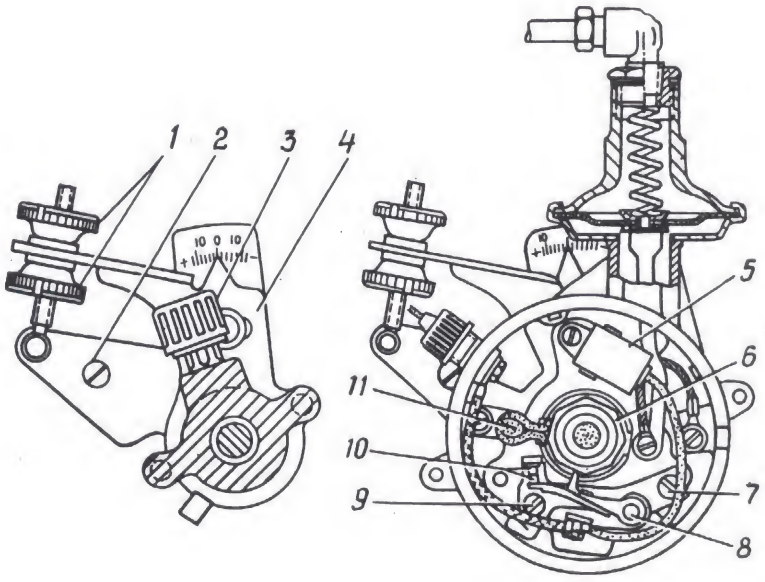


FIG. 85. IGNITION DISTRIBUTOR

1 – octane selector nuts; 2 – screw securing distributor to drive housing; 3 – grease cup; 4 – octane selector pointer; 5 – capacitor; 6 – breaker cam; 7 – eccentric adjusting screw; 8 – lever axle; 9 – locking screw; 10 – breaker points; 11 – wick oiler

(i) check the operation of the distributor and its pneumatic and centrifugal automatically controlled ignition advance devices on the test stand (if possible).

Spark Timing

Before spark timing (with the distributor and its drive removed from the engine), it is necessary to do the following:

(a) turn the engine crankshaft to set the piston of the 1st cylinder in TDC at the end of the compression stroke;

(b) reinstall the distributor drive;

(c) mount the distributor and the ignition wiring.

To set the piston of the 1st cylinder in TDC at the end of the compression stroke, proceed as follows:

1. Screw out the 1st cylinder spark plug.

2. Stop the spark plug hole with a finger and turn the crankshaft until compressed air is forced under the finger. This will take place at the beginning of the compression stroke in the 1st cylinder.

3. Remove the clutch housing hatch cover and watch the marks made on the flywheel through the hole in the housing.

4. Carefully turn the crankshaft until the ball on the crankshaft flywheel gets aligned with the pointer in the clutch housing port (Fig. 86).

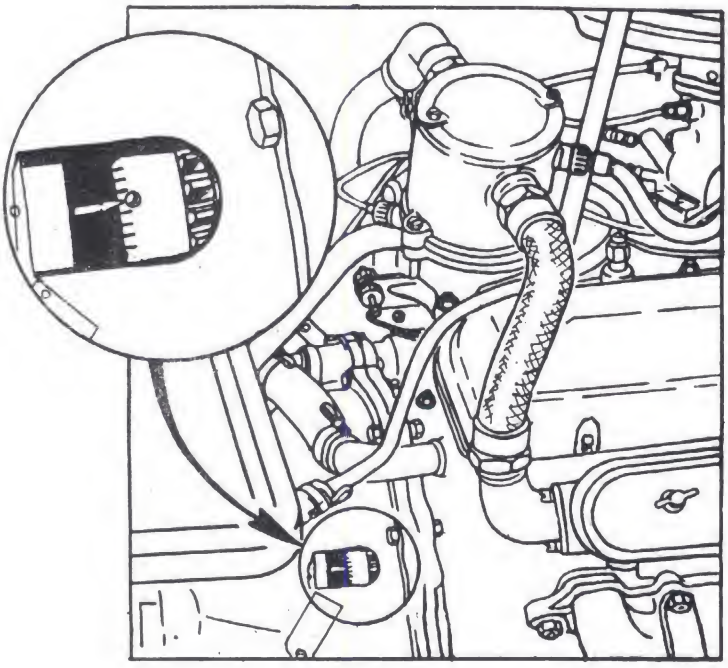


FIG. 86. SETTING THE PISTON OF THE 1st CYLINDER IN TDC

Installation of the distributor drive is performed after setting the piston of the 1st cylinder in TDC. To do this, proceed as follows:

(a) insert the distributor drive into the hole of the cylinder block so that the slot in the drive shaft is in line with the engine longitudinal axis and shifted to the right when viewed from the rear of the vehicle (Fig. 87);

(b) secure ignition distributor drive body 1 by means of holder 2 and nut 3 so that the bracket with the threaded hole on distributor drive body 1 is facing forward (towards the vehicle front) and turned through 23° leftwards from the engine longitudinal axis as shown in Fig. 87.

Installation of the ignition distributor is performed after installation of the distributor drive. To install the distributor, proceed as follows:

1. Set the piston of the 1st cylinder in TDC at the end of the compression stroke as described above.

2. Check, and, if required, adjust the gap in the distributor breaker.

3. Use nuts 1 (Fig. 85) to turn the distributor body so that octane selector pointer 4 is against zero.

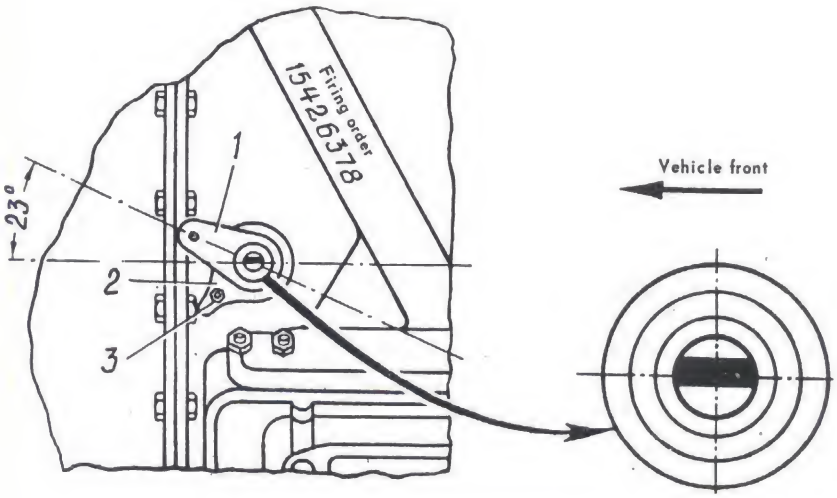


FIG. 87. INSTALLATION OF DISTRIBUTOR DRIVE
1 – drive body; 2 – holder; 3 – holder nut

4. Turn the distributor rotor so that it is facing the first terminal on the distributor cap (this terminal is designated 1 on the cap).

5. With the shaft in this position, insert the distributor into the drive hole and secure it in place with screw 2.

6. Connect the high- and low-tension wires from the ignition coil as well as the high-tension wires from the spark plug to the distributor in the following order: 1-5-4-2-6-3-7-8 as shown in Fig. 88.

Spark timing is adjusted after mounting the distributor in place as follows.

1. Set the crankshaft in the position when it is 4° before the position corresponding to TDC at the end of the compression stroke in the 1st cylinder. In this case, the ball on the crankshaft flywheel will be 4 divisions away from the TDC pointer.

2. Connect one lead of the check lamp to the ground (hull) and the other, to the low-tension terminal on the ignition distributor. The inspection lamp may be used for the purpose.

3. Switch on the ignition.

4. Loosen attachment nut 3 (Fig. 87) of the ignition distributor drive holder.

5. Carefully turn distributor drive body 1 together with the distributor clockwise to the position when the check lamp does not glow.

6. Press the rotor with a finger counterclockwise (in the direction opposite to its normal rotation) and gradually turn the distributor drive body counterclockwise until the check lamp glows. At the instant the check lamp lights up, stop turning the distributor drive body.

7. Tighten up attachment nut 3 of the distributor drive holder.

To carry out precision adjustment of spark timing, proceed as follows:

Warm up the engine until the temperature of liquid in the cooling system reaches 85°C. Drive the vehicle over a straight portion of the road in the fourth gear at a speed of not more than 25 km/h, then accelerate the vehicle up to 60 km/h by abruptly depressing the accelerator pedal up to the stop. If pinking is insignificant and short-time and disappears at a speed of 45 to 50 km/h, spark timing is correct. If pinking is heavy, rotate the octane selector nuts to turn the distributor body clockwise, thus decreasing ignition advance angle. If no pinking occurs, turn the distributor body counterclockwise. See that the vehicle is not operated for a long time with noticeable pinking.

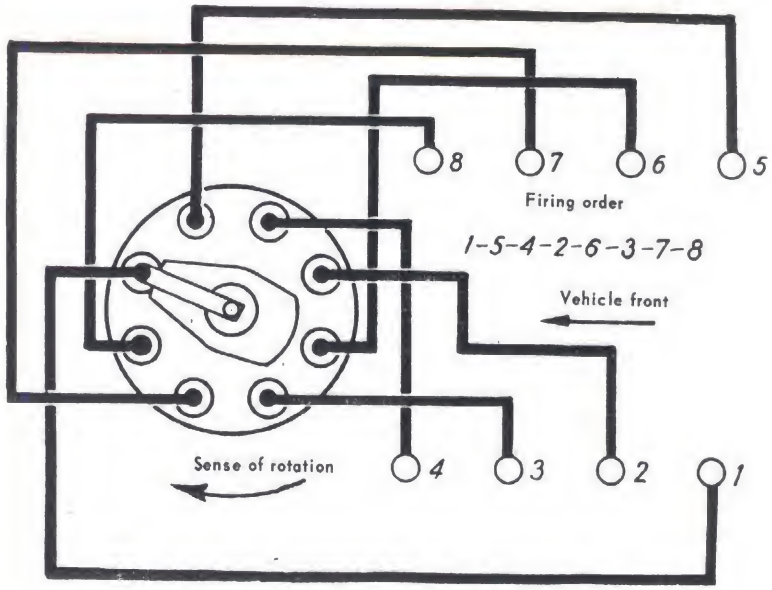


FIG. 88. CONNECTION OF WIRES RUNNING FROM SPARK PLUGS TO DISTRIBUTOR

The vehicle lighting system incorporates two headlights with blackout doors, two head lamps of the driver's night vision device, two side lamps, two rear lamps, a commander's light, air cock light, two dome lights in the engine compartment, instrument panel and turret control board lamps, inspection lamp, spotlight of the commander's night vision device, a fighting compartment dome light, and a turret dome light.

The side and rear lamps glow when the light switch knob is set in the first and second positions. Besides, the handle of the side and rear lamps switch must be turned clockwise to the ON (ВКЛ.) position. The headlights with blackout doors come on only when the light switch knob is in the second position (pulled all the way off).

Blackout devices (СМУ) comprise the headlight blackout doors, blackout mode switch located on the instrument panel, and side lamp inserts and rear lamp rims supplied with the vehicle (see Standard Equipment List). Inserts and rims should be installed when changing over to the blackout mode of operation.

Install the blackout inserts in the side lamps between the gasket and lens. The insert holes made for passing light should face downward.

To install the blackout rims on the rear lamps, proceed as follows.

1. Fasten the rim bracket to the lamp by making use of the lens attachment screws.
2. Install the rim on the lamp so that mark TOP (ВЕРХ) faces upwards.
3. Fasten the rim to the bracket by using shaped-head screws.

Headlights with Blackout Doors

The vehicle headlights have sealed optical systems that incorporate the reflector, blackout door and 28-V 40-W bulb.

The blackout devices permit the following three modes of operations:

(a) full blackout (ПЗ);

(b) partial blackout (ЧЗ);

(c) full light (НЗ);

With the full blackout mode of operation, the blackout system change-over switch cuts the series resistor into the lighting circuit, thus decreasing the headlight intensity of light.

Full Blackout

1. The covers of the headlight blackout doors are lowered and locked.
2. The blackout mode switch knob is set in position "1" (down).

Partial Blackout

1. The covers of the headlight blackout doors are in the same position as in the full blackout.
2. The blackout switch knob is set in position "2" (up).

Full Light

1. The covers of the headlight blackout doors are lifted and locked.
2. The blackout switch knob is set in position "2" (up).

Adjustment of Headlights with Blackout Doors

1. Position the vehicle (without the crew) with the tyre pressure of 2.8 kgf/cm^2 on a horizontal ground at a distance of 7.5 m from a special screen which is perpendicular to the vehicle longitudinal axis.

2. Plot on the screen:

(a) three vertical lines: the middle line opposite the vehicle axis and two side lines opposite the headlight centres (Fig. 89);

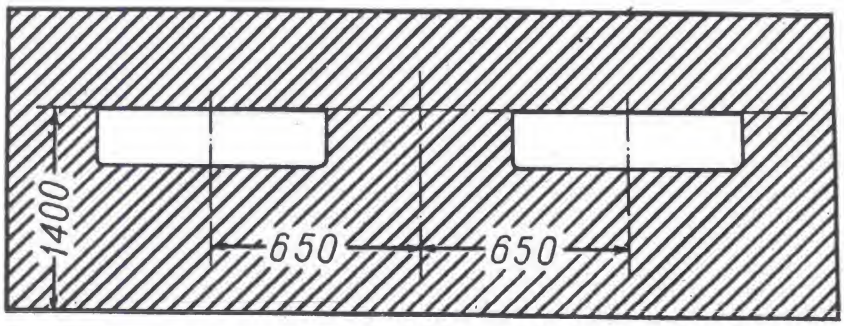


FIG. 89. HEADLIGHT ADJUSTMENT SCREEN

(b) one horizontal line at a height of 1400 mm from the ground.

3. Switch on the headlights in the full light mode and blind one of the headlights with a piece of opaque cloth.

4. Adjust the headlights with the door cover open. When adjusting the headlights, see that the brightest point of each light spot lies, respectively, on the right-hand or left-hand vertical lines and the shadow cast by the blackout door visor, i.e. the sharp boundary between the light zone and dark one is at the height of the horizontal line on the screen.

To do the adjustment, slacken the nuts securing the headlights to the brackets and turn the headlights until the above results are obtained.

After adjustment, the headlights nuts must be tightened up.

Dome Lights

One of the engine compartment dome lights is located on the right hull plate and the other, on the middle upright of the central bulkhead. The dome lights are used for illuminating the interior of the engine compartment when performing maintenance of various engine units, devices and mechanisms.

The fighting compartment roof plate bears a dome light that is switched on/off by the switch installed on the bracket located on the superstructure (hull upper portion) plate to the right of the commander's seat.

One dome light is mounted in the turret and used for illuminating the mechanisms located inside.

Turn Indicators and Marker Lights

Indication of the direction of the vehicle turn and marking of its clearance width at night is effected by the side lamps and rear lights. The rear lights also serve as stop lights.

The turn indicators are cut in by special indicator switch 11 (Fig. 93), and the side lamps by light switch 31. Both switches are located on the instrument panel.

Stop light comes on when the brake pedal is depressed. The stop light switch is located on the brake control master cylinder.

Switch 16 (Fig. 93) marked SIDE LAMPS, REAR LIGHTS (ПОДФАРНИКИ, ЗАДНИЕ ФОНАРИ) on the instrument panel permits switching off these lights when driving the vehicle in the day-time with the hatch doors closed and instrument lights switched on. In the daytime, the switch knob must be set in the OFF (ВЫКЛ.) position, and at night, in the ON (ВКЛ.) position.

When checking the turn indicator circuit for condition, never short the side lamp or rear light positive terminal to the ground when the turn indicator switch is cut in, as this may result in burning out of the turn indicator relay. Replace the bulbs in the headlights with the breaker cut out. After the lens and the gasket are removed from the side lamp, install them in the initial position (never turn them through 180°). Tighten the side lamp and rear light screws uniformly, without applying much effort, otherwise the lenses in the lights will be cracked.

Care of Lighting System

Maintenance of the vehicle includes the following operations:

1. Cleaning and wiping of the headlights and rear lights with clean rags, and checking the lights for proper attachment. Checking of the headlights, rear lights, commander's light, blackout mode switch, and turn indicator switch for proper operation. Checking of the position of the headlight blackout door covers and rear light covers (during Daily Maintenance). When carrying out Daily Maintenance after operation on water, it is necessary to remove the side lamp lenses, clean the inner surface of the side lamps of dirt, and wipe them dry.

2. Adjustment of the headlights. This is performed when necessary, i.e. when the headlight attachment becomes loose or the headlights are reinstalled on the vehicle.

3. Visual inspection and cleaning of the headlight interior of dirt, when necessary (during Preventive Maintenance No. 2, every 6000 km of run).

Open the headlights only in case of necessity. See that the gaskets are good and serviceable and blackout doors are tightly secured. When replacing the bulbs, take care not to touch the reflector or to leave sweat or fat prints on the bulbs.

When replacing the lamps it is necessary to use clean cloth for wrapping the bulb during its fitting in the lamp holder and for wiping the reflector and lamp upon replacement.

HORN

The vehicle is equipped with an electrical vibratory, sealed horn. If the sound is hoarse or low adjust the horn by turning the adjusting screw which is located on the rear wall of the horn body and is covered with a cap nut.

If turning of the adjusting screw does not bring about the satisfactory result, screw off the horn resonator nut and turn the resonator through 1/4 of a revolution, then tighten up the nut and check the horn sound while turning the adjusting screw to this or that side.

Repeat this operation until the required tone is obtained.

ELECTRIC CONTROL OF AIR INLET AND OUTLET DOORS

The doors of the air inlet and outlet ports are opened and closed by means of an electric control.

Secured on housing 6 (Fig. 90) is control motor 4 and two limit switches 8 and 3. Limit switch 8 disconnects control motor 4 when the doors are fully shut and limit switch 3 disconnects the motor when the doors are fully open.

The electric control is actuated by a switch having no fixed extreme positions. The switch is mounted near the air cock light on the sloped plate of the superstructure to the left of the driver. Shifting the switch handle upward opens the air inlet and outlet doors, and shifting the handle downward closes them.

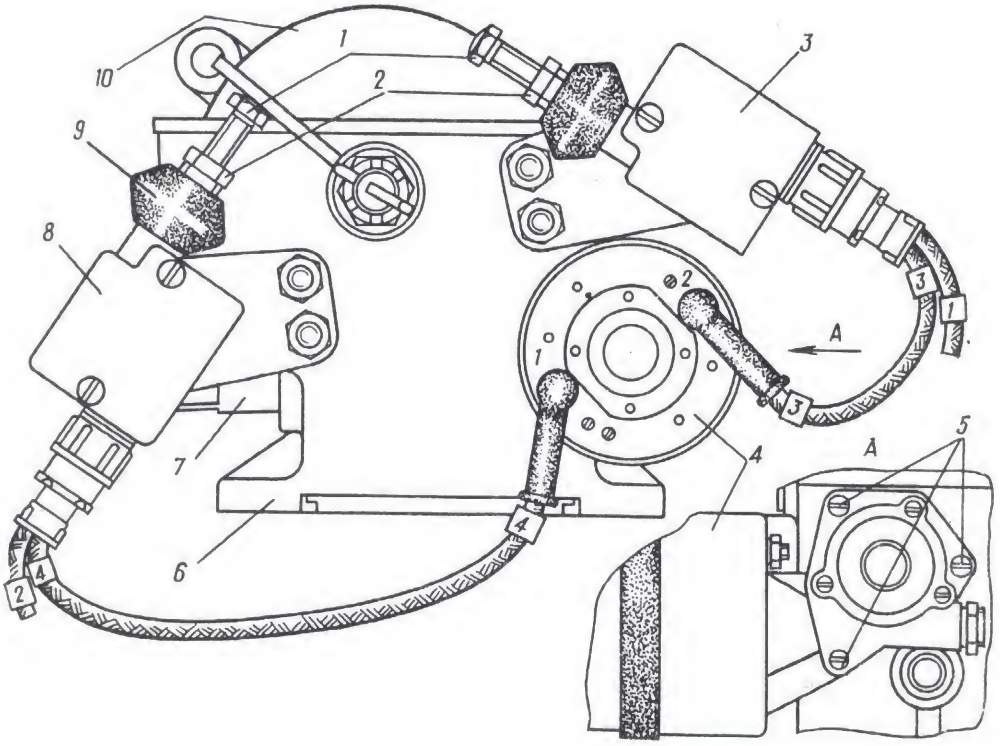


FIG. 90. INSTALLATION OF LIMIT SWITCHES OF AIR INLET AND AIR OUTLET DOORS ELECTRIC CONTROL

1 – adjusting bolts; 2 – lock nuts; 3 – limit switch for doors opening; 4 – control motor; 5 – motor attachment screws; 6 – control housing; 7 – reducer worm shaft; 8 – limit switch for doors closing; 9 – protective casing; 10 – housing cover

When replacing the limit switches or in case of maladjustment of the cut-off system for electric motor 4 when the doors fail to open or close completely, or in case closing of the doors causes impermissible deformation of the control rods, the limit switches must be adjusted.

To carry out the adjustment, proceed as follows:

(a) open (close) the doors until the limit switch operates;

(b) slacken lock nut 2 of a corresponding limit switch;

(c) screw in (if the doors fail to open[*] or close completely) or off (if deformation of the rods takes place) adjusting bolt 1 of a corresponding limit switch so that the doors open and close regularly, and then tighten lock nut 2.

[*] When opened, the lower edge of the air inlet doors must be 40 to 50 mm above the surface.

(d) check the limit switches for proper adjustment by opening and closing the doors several times.

To check the limit switches for proper adjustment, shift the switch handle to the opening (closing) position with the engine inoperative and air inlet and outlet doors fully opened (closed). The voltammeter pointer must remain motionless in this case. The deflection of the pointer indicates that the limit switch is faulty. In this case readjust the limit switch.

WARNING. 1. If the wires of the control motor or the limit switch connectors were disconnected, check whether they are connected properly according to their marking prior to switching-on of the control (see Fig. 90).

2. Simultaneous opening or closing of the doors is not adjusted by the limit switches. The adjustment is effected by the rods.

Care of the electric control consists in keeping it always clean. Every 6000 km of run proceed as follows:

1. Lubricate the rubbing surfaces of the control with lubricant ЦИАТИМ-201, upon removing cover 10 secured to housing 6 by two screws.

2. Lubricate the stems of the limit switches. For this purpose, take off protective casing 9, remove dirt and coat the stem with fat grease 1-13, and then shift the stem several times by pressing bolt 1 to uniformly distribute the grease. This done, reinstall protective casing 9.

In case control electric motor 4 fails to operate, the doors may be opened or closed manually.

For this purpose:

(a) screw out three attachment screws 5 and remove electric motor 4 jointly with the reduction gear;

(b) use the 12-mm wrench to rotate shaft 7 of the reduction gear worm.

WINDSHIELD WIPER

The vehicle is equipped with an electric double-blade windshield wiper. The windshield wiper is cut in by means of a switch located on the electric motor reduction gear. The windshield wiper can be operated manually, for which purpose the handle located on the reduction gear should be pulled off and then driven by hand.

To ensure proper functioning of the windshield wiper, keep the surface of windshields always clean of grease and other stains.

If water leaks inside the vehicle through the axle of the windshield wiper arm, lubricate the bushing of the arm axle with lubricant ЦИАТИМ-201 through the lubrication fitting mounted on the bushing. Be sure to lubricate the arm axle bushing when carrying out Seasonal Maintenance.

Every other Preventive Maintenance No. 2, lubricate the hinged joints of the windshield wiper arms with lubricant ЦИАТИМ-201.

SPEEDOMETER

The vehicle is equipped with a speedometer for display of the speed of movement and kilometrage covered. Care of the speedometer consists in keeping it always clean. After five years of operation (storage), lubricate the drive shaft through the lubrication fitting installed on the instrument shank while taking care not to break the flexible shaft seal.

To lubricate the drive shaft, proceed as follows:

1. Disconnect the wire of the horn button, the U-bolt securing the steering column, and the air pipe of the tyre pressure gauge, and remove the instrument panel.

2. Loosen the screws securing the speedometer to the instrument panel.

3. Remove dirt from the lubrication fitting stopper and clean the lubricating hole.

4. Drip five or six drops of isoparaffin oil I or instrument oil ОКБ 122-7, (GOST 18179-72).

5. Close the hole with lubricant ЦИАТИМ-221 (GOST 9433-60) or oil ОКБ 122-7 (GOST 18179-72).

Upon lubrication, install the instrument panel in the authorized position.

Flexible Shafts of Speedometer Drive and Travelled Distance Sending Unit of Navigational Equipment

The vehicle is equipped with two flexible shafts: one (type ГВ-304) runs from the transfer case to the travelled distance sending unit of the navigational equipment, and the other (type ГВ-305А) runs from the travelled distance sending unit to the speedometer. In case the navigational equipment is not installed in the vehicle, only one flexible shaft (type ГВН-300Ж) is used.

After 15,000 km of run, the flexible shafts must be lubricated. A symptom indicating the need of lubrication is knocking of the flexible shaft and fluctuation of the speedometer pointer.

For lubrication, remove the cable lock washer on the drive side, remove the flexible shaft from the vehicle, and withdraw the cable from the sheathing. Then, wash the cable in kerosene, wipe the flexible shaft and coat 2/3 of the cable length on the drive side with lubricant ГОИ-54п or ЦИАТИМ-201.

When installing the flexible shaft, secure it with clips and make curves of the cable sheathing round. The radius of the curves should be at least 150 mm; see that the flexible shaft length is evenly distributed over the entire run. Tension of the flexible shaft at the curves and fractures of the sheathing are not tolerable since they will inevitably cause premature breakage of the cable.

ELECTRIC WIRING

The vehicle electric wiring is made of shielded wire, grades ПГВАЭ, БПВЛЭ and ПТЛЭ-200.

When operating the vehicle, bear in mind the following:

1. To avoid short-circuits and fire, all operations on the electrical equipment (including its servicing and dismantling) must be carried out with the storage battery disconnected by means of the battery switch.

2. When mounting the instrument panel, pay particular attention to position of the wire shielding and the instrument terminals relative to each other. Prevent any possibility of contact between the shielding and terminals when mounting the instrument panel.

3. Solder the wires and wire lugs without acid.

4. The low-tension wires of the ignition coil should be terminated as shown in Fig. 91, A.

5. Termination of wires in the connectors of the generator, distributor, radio interference filters should be performed as shown in Fig. 91, B.

6. Metal wire braiding of all the connectors and individual leads must be grounded.

7. Avoid significant tension of the wires during maintenance operations and inspections, otherwise their braiding came off, fit the braiding again. In doing this, use all the surplus length of the wire. The termination should be done accurately. Case should be taken to keep the wires strands clear of the braiding.

When screwing on/off the lug nuts, make sure the shielding is not twisted, otherwise the braiding may be damaged and electrical contact disturbed.

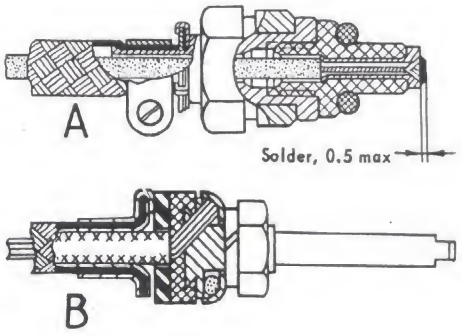


FIG. 91. WIRE TERMINATION

A – to ignition coil; B – to generator, distributor, filters, voltage divider

Rubbing of the wires against various levers and rods is not permissible.

To ensure adequate sealing, the union nuts of all the pipe unions and particularly the ignition coil nuts must be reliably tightened. To avoid damage to the pipe unions in tightening, use combination pliers or other tools for the purpose only in exceptional cases.

8. The wire shielding that terminates in screw-connected lugs must be always provided with the sleeves that prevent the braiding from slipping off and the circuits from short-circuiting.

9. Replacement of shielded wires with non-shielded ones as well as operation of electric motors without capacitors are not permitted.

10. Check condition of the electric wiring contacts and cottering of all the joints every 1000 km of run (during Preventive Maintenance No. 1).

The tightening of wire lugs should provide constant and reliable electric contact. Do not operate the vehicle with loose lug screws and nuts.

If the connector nuts are uncottered, tighten them up and cotter again.

The wires should be connected to the lugs or plugs in such a way that the stripped end of the wire keeps all the strands. Failure to observe this requirement may lead to unnoticeable sparking and increased radio interference.

PROTECTIVE DEVICES

The vehicle electrical system employs thermal bimetallic protective devices and automatic switch-type circuit breakers which are used, besides, as switches. They serve for protection of the wiring from overloading and short-circuits. The protective devices are installed on the instrument panel, in the control unit of the engine starting preheater and on the socket panel of the inspection lamp.

When excessive current caused by a defect in a circuit or consumer passes through bimetallic strip 3 (Fig. 92), the strip heats and deflects in the opposite direction thus breaking the circuit. After the defect in the circuit is eliminated, the protective device may be cut in by momentarily pressing return push button 4. Do not keep the return push button pressed as it may lead to destruction of the protective device if the fault in the circuit is not yet eliminated.

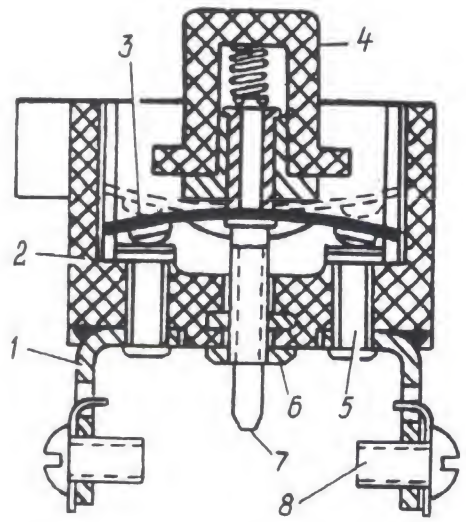


FIG. 92. THERMAL BIMETALLIC BUTTON-TYPE CIRCUIT BREAKER

1 – terminal; 2 – body; 3 – bimetallic strip; 4 – return push button; 5 – contact; 6 – nut; 7 – adjusting screw; 8 – terminal screw

In case of short-circuiting, the automatic switch-type circuit breaker automatically opens the circuit and its knob comes to the OFF position. Upon elimination of the trouble, set the automatic switch-type circuit breaker knob in the ON position. When doing so, do not retain the knob by hand. If the automatic switch-type circuit breaker gets cut out again, it means there is still trouble in the circuit. In this case, detect and eliminate the trouble and then cut in the automatic switch-type circuit breaker again.

INSTRUMENT PANEL

All the electrical instruments of the panel (Fig. 93) are mounted on a detachable board and inclosed in a metal case (shield) reducing intensity of radio interference.

Mounted directly on the instrument panel (outside the shield) are speedometer 15, tyre pressure gauge 17, side lamps and rear lights switch 16, course indicator 13, and blackout mode switch 14.

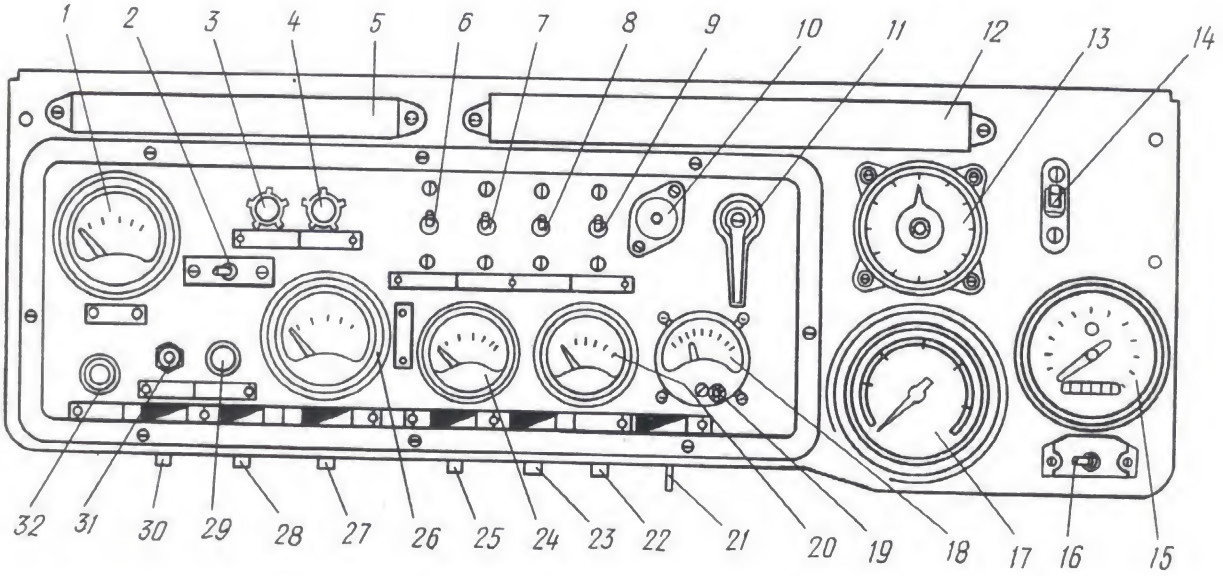


FIG. 93. INSTRUMENT PANEL

1 – coolant temperature gauge indicator; 2 – fuel gauge sending units switch; 3 – windshields defroster switch; 4 – heater switch; 5 and 12 – light reflectors; 6 – ignition switch; 7 – bilge pump switch; 8 – TKH-1C device spotlight switch; 9 – TBHO-2Б device headlights switch; 10 – turn indicators pilot lamp; 11 – turn indicators switch; 13 – course indicator; 14 – blackout mode switch; 15 – speedometer; 16 – side lamps and tail marker lights switch; 17 – tyre pressure gauge; 18 – voltammeter; 19 – voltammeter button; 20 – fuel gauge; 21 – protective device of turn indicators breaker; 22 – protective device of radio set circuit; 23 – protective device of TBHO-2Б device power pack circuit; 24 – oil pressure gauge; 25 – protective device of navigational equipment circuit; 26 – oil temperature gauge indicator; 27 – protective device of horn and windshield wiper circuit; 28 – protective device of turret power supply circuit; 29 – radiators coolant overheating pilot lamp; 30 – protective device of lighting circuit; 31 – starter button switch; 32 – light switch

Mounted on the instrument board (inside the shield) are the following instruments:

1. Coolant temperature gauge indicator 1.
2. Engine oil temperature gauge indicator 26.
3. Oil pressure gauge 24.
4. Fuel gauge 20.
5. Voltammeter 18.
6. Turn indicators switch 11.

In addition to the above instruments, the instrument board houses all the switching equipment of electrical mechanisms, coolant overheating pilot light 29 (red) and turn indicators pilot lamp 10 (green).

Built into the casing of speedometer 15 is a blue pilot lamp glowing when the headlights of driver's night vision device TBHO-25 are switched on.

The instrument panel is illuminated by the lamps located above the instruments. Their light is directed to the instruments by means of special light reflectors 5 and 12. In addition, the speedometer, fuel gauge, indicators of temperature gauge and pressure gauge are provided with scale internal illumination. Intensity of the instrument scale illumination and illumination of the instrument panel can be adjusted by turning the knob of light switch 32.

Mounted inside the shield are two terminal (junction) blocks, the turn indicators breaker and bimetallic circuit breakers 21, 22, 23, 25, 27, 28, 30.

Care of Instruments

1. When removing the coolant temperature gauge and fuel gauge sending units, insulate the ends of the cables to avoid short-circuiting.

2. If, for some reason, the fuel gauge sending units have been removed, place a new gasket or coat the gasket with shellac or paint to maintain tightness of the tank when reinstalling the sending unit.

3. Keep the coolant level in the cooling system within the prescribed limits, as the coolant temperature gauge sending unit may become unserviceable due to overheating.

GENERAL PROCEDURE FOR ELECTRICAL CIRCUIT TROUBLE SHOOTING

Malfunctioning of power consumers (electric motors, instruments or lighting units, etc.) means trouble in an electric circuit.

The following troubles may be encountered:

(a) broken or faulty contact in the cables connecting the consumer with the power source;

(b) defective circuit breaker, switching equipment or connecting element;

(c) short-circuit or overloading in the circuit that makes the circuit breaker operate.

Before checking the circuit, make sure that the circuit breaker is in the ON position. The automatic switch-type circuit breaker (A3C) is cut in with a knob which must be set in the ON position, while the bimetallic circuit breaker is cut in by pressing its push-button.

To check the electric circuit, proceed as follows:

(a) turn on the battery switch;

(b) cut in the circuit to be checked with the power consumer.

In case the consumer does not operate and the circuit breaker fails to cut out, the circuit or the consumer is defective. If the circuit breaker cuts out the circuit, it means that the circuit is shorted. Detect the short-circuit point and eliminate the trouble before cutting in the circuit breaker again.

Note. Do not keep the circuit breaker push-button or switch-type circuit breaker knob in the ON position for more than one second, as with faulty (shorted) circuit the wiring and the circuit breaker may become unserviceable.

Circuit Continuity Test

Discontinuity in wires is detected with a pilot lamp which indicates voltage in the circuit. The inspection lamp available in the vehicle accessory kit may be used for the purpose. To perform the test, the pins of the inspection lamp plug must be elongated by attaching length of insulated wires with insulation removed on both ends of the wire. Start checking the circuit for voltage from the power consumer terminals.

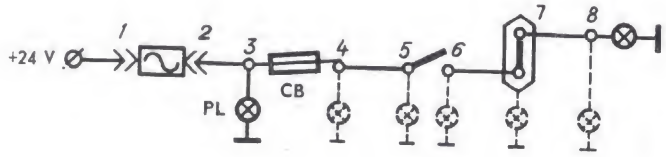


FIG. 94. CIRCUIT CONTINUITY TEST DIAGRAM

The following variations are possible in this case.

1. Consumer terminals are energized: the consumer is defective and must be replaced.

2. Consumer terminals are deenergized: check consecutively for voltage across connecting elements (junction plates, connectors, etc.).

3. Connecting elements are energized: wire is broken or contact is faulty. In this case, depending on the type of trouble, the contact must be tightened or wire replaced.

4. Connecting elements are deenergized: turn out the instrument panel board fastening screws to gain access to the circuit breaker and switch terminals and check the circuit breaker and the instrument panel supply circuit for operation. To make sure that the circuit breaker is sound, it is sufficient to check voltage across its two terminals. If one of the terminals is deenergized (though the circuit breaker is on), the circuit breaker is defective and must be replaced.

Given below are the examples of how to detect the defective circuit breaker, switching equipment, connecting element or broken wire.

1. Points 8, 7, 6, 5, 4 (Fig. 94) are deenergized (pilot lamp PL does not glow), point 3 is energized (pilot lamp glows): circuit breaker CB is faulty.

2. Points 8, 7, 6, 5 are deenergized, point 4 is energized: the wire is broken or contact of points 4 and 5 is faulty, and so on.

Short-Circuit Test

In case the circuit breaker opens the circuit when the latter is cut in, detect the short-circuit point in the following way:

(a) turn out instrument panel board fastening screws;

(b) disconnect the feeder of the circuit to be checked and connect pilot lamp PL (Fig. 95) between the disconnected feeder and the terminal from which the feeder is disconnected;

(c) cut in the circuit to be checked (the pilot lamp should glow);

(d) disconnect in succession the wires in the circuit being checked starting with the power consumer (until the pilot lamp PL goes out), and find the point of short-circuit.

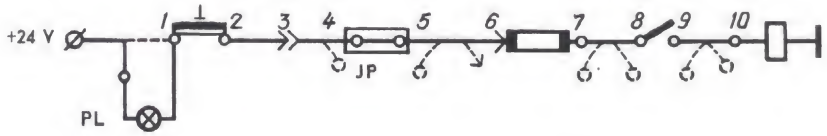


FIG. 95. SHORT-CIRCUIT TEST DIAGRAM

In case the consumer is defective, replace the consumer. In case wiring is defective, replace the faulty wire. In case the defect is insignificant, insulate the trouble point using insulating tape included in the vehicle kit.

Given below are the examples of finding short-circuit in the vehicle electrical system.

1. With wires disconnected from terminals 10, 9, 8, 7 and 6, pilot lamp PL does not go out; with the wire disconnected from terminal 5, the pilot lamp goes out: run 5-6 is short-circuited.

2. With wires disconnected from terminals 10, 9, 8, 7, 6 and 5, the pilot lamp does not go out; with the wire disconnected from terminal 4, the pilot lamp goes out: junction panel JP is short-circuited.

ELECTRICAL EQUIPMENT TROUBLES AND REMEDIES*

Trouble symptom and cause	Remedy
Storage battery becomes quickly discharged: dirty storage battery; current leakage due to defective storage battery or electric circuit	Clean storage battery of dirt. Storage battery discharge with storage battery switch turned off means short-circuit in storage battery proper, and it must be replaced. Discharge of storage battery when its switch is turned on means current leakage due to a defect in vehicle mains which must be found and eliminated
Starter fails to drive engine:	
(a) oxidized storage battery terminals or wire lugs;	Clean storage battery terminals and wire lugs, tighten them
(b) faulty or heavily discharged storage battery;	Replace storage battery or recharge it
(c) broken starter or starter relay feeding circuit	Find fault in circuit and eliminate it
Starter drives engine at low speed:	
(a) battery is discharged below permissible limit;	Recharge battery
(b) short-circuit in one of battery cells;	Replace battery
(c) deep voltage drop in starter feeding circuit	Clean storage battery terminals, tighten starter wires holding parts

* Ignition system troubles and remedies are outlined in Chapter 2 ("Power Plant").

Continued

Trouble symptom and cause	Remedy
Starter fails to start running:	
(a) discharged storage battery;	Check storage battery for condition, recharge or replace it, if necessary
(b) broken starter or starter relay feeding circuit;	Use inspection lamp to check voltage across starter relay terminals with starter switch push-button depressed If even one of terminals is deenergized, detect the trouble point and remedy
(c) defective starter relay (broken windings, bound armature) or generator regulator	If starter fails to start running, disconnect wire from terminal "РС" of generator regulator and connect it temporarily to terminal "+" (positive) or "Б" of generator regulator. Carry out this operation carefully so that a reliable contact is provided that prevents burning and melting of lug of wire "РС" and terminals. If starter fails to start after that, generator regulator cut-in and interlocking device is serviceable, and starter proper or its wiring is defective. If starter starts running, generator regulator cut-in and interlocking device is faulty. In both cases, defective units must be dismounted for checking and repair in repair shop or replaced with new ones. If it is necessary to start engine when cut-in and interlocking device is defective, cut in starter by connecting wire "РС" with terminal "+" (positive) or "Б" of generator regulator
Starter interlocking fails. Starter does not stop though engine gets running or comes on when engine runs (inherent scrunch is heard):	
(a) defective wiring;	Eliminate defect
(b) missing contact in connections $Л_1$ and $Л_2$ of generator or generator regulator;	Restore contact in connections
(c) faulty generator regulator or generator	Replace generator regulator or generator. To find defective unit, disconnect wires $Л_1$ and $Л_2$ from generator regulator, start engine, and measure voltage across these wires at idling speed. If voltage does not show or is less than 13 V, generator is defective. If voltage is 13 V or more, generator regulator is defective Note. Voltage may be checked by means of pilot lamp connected to wires $Л_1$ and $Л_2$ (24 V lamp must be partially heated). If lamp does not glow though engine operates, generator is defective.
Starter gets off before engine is started: defective generator regulator	Replace generator regulator
Rapid evaporation of electrolyte in storage battery: too high voltage	Check generator regulator in repair shop and adjust, if necessary

Trouble symptom and cause	Remedy
Ammeter does not show charging or shows discharge though engine runs:	
(a) slipping generator drive belts;	Adjust belt tension. When a force of 4 kgf is applied to generator drive belts, deflection of each belt must be 11 to 13 mm
(b) faulty voltammeter (showing no discharge when consumers are fed at halt);	Replace voltammeter
(c) broken contact of power cables running from terminal "Б" of generator regulator to filter Ф-5, from filter Ф-5 to ammeter shunt, and from shunt to storage battery positive terminal;	Check contacts and, when necessary, clean them and tighten up nuts
(d) maladjusted voltage regulator that is indicated by decreased voltage (below 26.5 V) across terminal "Б" and ground while engine runs at medium speed and turned-off battery switch;	Send generator regulator to repair shop for adjustment
(e) if upon turning on battery switch, voltmeter indicates battery voltage of 24-25 V and, upon turning off battery switch, voltmeter indicates zero, possible trouble cause is generator or generator regulator. In this case, first check for voltage across terminal "Ш" of generator regulator with wire "Ш" disconnected. Check with 15 W pilot lamp (use of inspection lamp is permissible). In case lamp fails to glow with ignition cut in, generator regulator is defective;	Replace generator regulator
(f) if in above checking pilot lamp glows, connect wire "Ш" to generator regulator and check for voltage ac-	Eliminate defect or replace generator

Continued

Trouble symptom and cause	Remedy
ross generator plug "Ш". If voltage is detected, remove generator protective casing and check for voltage across brush holder insulated terminal. If electric circuit is good, remove brush holder and check whether brushes stick. Then use a conductor to short terminals "+" (positive) and "Ш" of generator regulator, start engine and gradually increase its speed up to 1500 r/min while making sure that charging current flows. If current is not indicated, generator is faulty	
Ammeter indicates intensive charging current for long: (a) operate engine at medium speed and measure voltage across terminal "Б" of generator regulator to ground with storage battery switch turned off. If voltage is regular (26.5 to 28.5 V), generator regulator is good, and intensive charging current results from heavily discharged storage battery;	Send storage battery for recharging
(b) voltage exceeds limit value which means that generator regulator is faulty	Dismount generator regulator and send it to repair shop for readjustment, or replace it with new one
Some lamps do not glow: (a) burnt filament;	Replace bulbs with new ones
(b) poor contact in lamp holder (this trouble is most frequent in headlight holders)	Bend off spring contacts and check for reliable connection. Apart from main spring contact, plastic cover of headlight optical system has a contact which connects reflector to ground: this contact must be securely pressed to cylindrical part of reflector
Stop lights (built in tail lights) do not glow when braking vehicle: (a) broken contact of wire and stop light switch;	Restore connection
(b) faulty stop light switch	Check switch by shorting its terminals. If stop light appears, switch is faulty and requires replacement
Stop lights (in rear lights) glow permanently: stop light switch contacts are shorted	Replace stop light switch

Continued

Trouble symptom and cause	Remedy
Filaments often burn off in electric bulbs: too high voltage	Send generator regulator to repair-shop for readjustment, or replace it
Turn indicators fail to operate:	
(a) defective automatic switch-type circuit breaker A3C-2;	Replace circuit breaker
(b) defective (burnt) turn indicator relay.	Replace defective relay
Never check voltage across contacts of side lamp and rear light bulb holders by shorting to ground, and never replace electric bulbs of side lamps and rear lights when turn indicator is cut in	
Horn does not sound and does not consume current:	
(a) circuit breaker cuts off feeding circuit;	Eliminate cause leading to cutting-off (short-circuiting is possible)
(b) broken horn push button wire;	Repair wire
(c) poor contact of horn push button to ground;	Disassemble push button, clean contact surfaces
(d) maladjusted circuit breaker contacts (contacts are open)	Adjust signal
Horn does not sound but drains intensive current due to caking of contacts	Clean contacts and adjust horn, then, provide for tightness of horn
Horn sounds hoarsely due to maladjustment	Adjust horn
Turning of steering wheel leads to spontaneous sounding of horn:	
(a) loose push button spring;	Adjust spring
(b) skew fork contacts	Straighten fork
Oil pressure gauge pointer indicates zero despite pressure varies, or even goes leftwards beyond zero:	
(a) lost contact of gauge terminal "Д" with sending unit terminal;	Check connecting circuit

Continued

Trouble symptom and cause	Remedy
(b) deenergized gauge terminal "Б"	Check connecting circuit
Pressure gauge pointer goes out of scale (off-scale reading) though oil pressure varies:	
(a) lost contact of gauge housing and vehicle hull (ground);	Restore contact
(b) defective instrument	Replace instrument
(c) in all other cases failure of gauge is caused by faulty sending unit	Check sending unit and replace it, if necessary
Fuel gauge pointer indicates zero at any fuel level in tank:	
(a) lost contact of gauge housing or sending unit body with vehicle hull (ground);	Restore contact
(b) deenergized terminal "Б" of gauge;	Check feeding circuit
(c) defective instrument	Replace instrument
Fuel gauge pointer indicates overfilled tank (off-scale reading) though fuel level in fuel tank varies:	
(a) defective fuel sending unit;	Replace fuel sending unit
(b) lost contact of sending unit terminal with gauge terminal "Д";	Check connection circuit
(c) defective instrument	Replace instrument
Water temperature gauge pointer is to the left of point "40" whatever real temperature in engine:	
(a) deenergized gauge terminal "Б";	Check connection circuit
(b) lost contact of gauge terminal "Д" with sending unit terminal;	Same
(c) defective instrument	Replace instrument
Water temperature gauge pointer gets beyond point "120" (off-scale) whatever water temperature in engine:	

Continued

Trouble symptom and cause	Remedy
(a) lost contact of gauge housing with vehicle hull (ground);	Restore contact
(b) defective instrument;	Replace instrument
(c) in all other cases failure of gauge is caused by faulty sending unit	Check sending unit and replace it, if necessary

Chapter 10

VISION DEVICES

GENERAL

To observe the road and terrain, the vehicle is equipped with special devices (Fig. 96) for the commander, the driver and the crew.

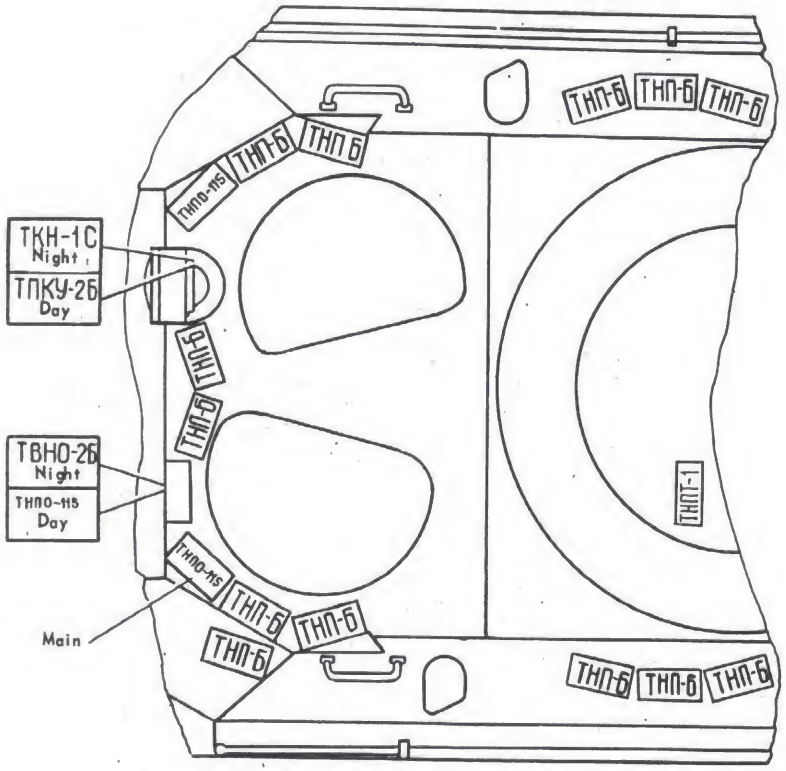


FIG. 96 ARRANGEMENT OF VISION DEVICES

Depending on the combat situation, the commander in the day-time observes the road and terrain through vision devices type ТПКУ-2Б, type ТНП-Б and type ТНПО-115, or through the windshield. To observe the road and terrain at night, the commander makes use of night vision device, type ТКН-1С. Vision devices ТПКУ-2Б and ТКН-1С, depending on the time of the day, are mounted alternately in one and the same shield located in the front armour plate in front of the commander (Figs 96 and 106). Vision

devices TKH-1C and TПКУ-2Б are stowed alternately in the box of device TKH-1C which is kept in the bay between the front right-side wheel and auxiliary wheel.

Vision device TПКУ-2Б (Fig. 97) is a periscopic system with 5X magnification and field of vision of 7°30'. Instructions on use of this device are outlined in the Brief Description and Operating Instructions for vision device TПКУ-2Б, supplied to the vehicle and kept in the device stowage box.

Vision devices TНПО-115 and TНП-Б (Fig. 98) are mounted in special seats and can be easily removed. Tightness of these devices is ensured by special rubber gasket 2 which is trapezoidal in section. In case tightness is lost, compress the gasket. For this purpose, remove the device and disconnect clamp 3 (Fig. 102) from yokes 5, then screw in the yokes through the required distance, connect clamp 3 with yokes 5 and reinstall the device.

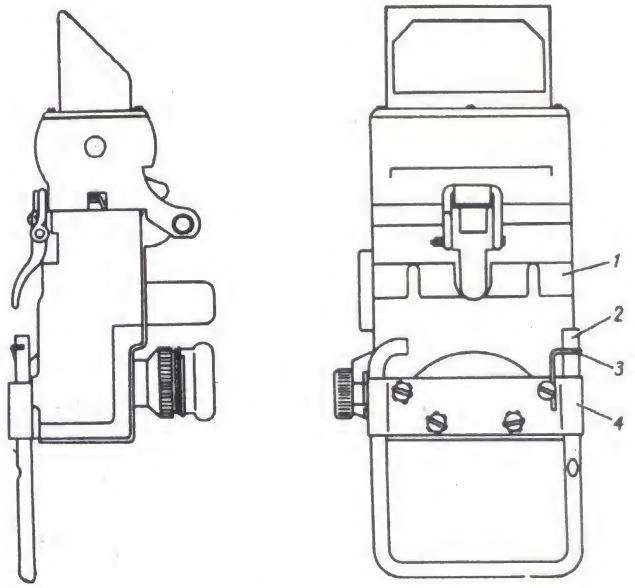


FIG. 97. COMMANDER'S DAY-TIME VISION DEVICE TПКУ-2Б
1 – vision device TПКУ-2Б; 2 – handle; 3 – spring; 4 – strap

Vision devices TНПО-115, in distinction to vision devices TНП-Б, are provided with electrical heating system which improves observation at low temperatures when the upper and lower prisms are fogged or covered with frost.

The electric heating system is used in case observation is impeded

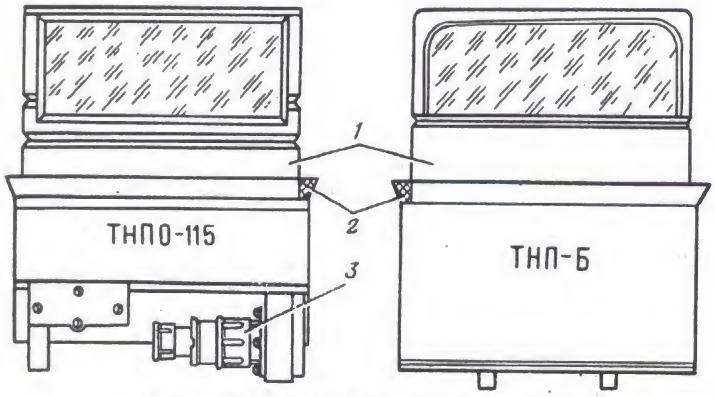


FIG. 98. VISION DEVICES TНПО-115 AND TНП-Б
1 – vision device; 2 – gasket; 3 – plug connector

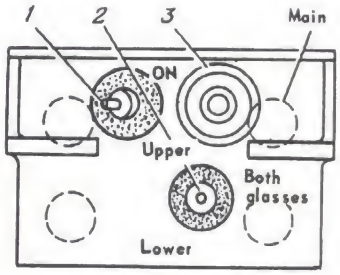


FIG. 99. GLASS TEMPERATURE REGULATOR PTC-27-3A
1 – heating switch; 2 – heating mode change-over switch; 3 – pilot lamp
Shown in dotted lines are plug connectors arranged on opposite side of regulator

by weather. The heating system is cut in for all the three devices simultaneously by means of the switch located on glass temperature regulator PTC-27-3A which is secured on a special bracket behind the driver's hatch (see Fig. 102). In addition to main switch 1 (Fig. 99), glass temperature regulator PTC-27-3A has change-over switch 2. The latter is used to apply the heating system to the upper prisms of the device, to the lower prisms, or to both.

When the electric heating system is cut in, the optimum temperature inside the devices is maintained automatically. Mounted on glass temperature regulator PTC-27-3A

is pilot lamp 3 which glows when the heating system operates and goes out when the heating system is manually or automatically cut out. It is not advisable to use the electric heating system at an ambient temperature above +5°C.

The TNPO-115 devices electric heating system is checked for serviceability in all cases (including the checking at positive ambient temperatures but not above +25°C) by switching on electric heating. The electric heating operation can be felt by touching the heated prisms with hand.

Causes of faults and remedies are discribed below in the table "Main Troubles of Night Vision Devices and Remedies".

When connecting the bundle of wires to the temperature regulator (if connectors have been detached; it is necessary to pay attention to proper connection of main device TNPO-115. It should be joined to a connector marked MAIN (ВЕДУЩИЙ) (see Figs 96 and 99). Six wires of main device TNPO-115 and three wires of two other devices TNPO-115 each are attached to the connectors intended for coupling devices TNPO-115. Check the devices for proper connection in the operation. Improper connection will result in failure of switching the devices heating (pilot lamp 3 (see Fig. 99) does not glow).

Failure of main device TNPO-115 may lead to stopping of heating of prisms of other devices TNPO-115 (TVNO-2B) or may result in overheating the prisms. In this case replace the main device with a new one, if available, or replace it with any guided device, then check the devices for serviceability following the above described procedure.

The driver carries out observation in the day-time through devices TNP-B, TNPO-115 or through the windshield depending on the combat situation, and at night through night vision device TVNO-2B installed in the seat of vision device TNPO-115 in front of the driver (Figs 96 and 102). The driver's vision devices TVNO-2B and TNPO-115 are stowed alternately in one and the same box whichever is not used. The box is kept in its authorized place in the bay between the front left-side wheel and the auxiliary wheel.

Device TNPT-1 is installed on the turret roof to observe the road and terrain in the rear field of view of the turret mount gunner. The device field of vision in horizontal plane is 52°, in vertical plane, 12°.

Vision device 5 (Fig. 100) is located in socket 4 and is secured with four bolts 2. The device installation tightness is provided by rubber gasket 3. In case of disturbance of tightness, tighten up bolts 2.

An entrance pupil of device seat 4 is covered by armoured shutter 6 with the aid of handle 8 of the control located inside the turret. With the shutter in the open and closed position the control is secured with retainer 7.

Vision device TNPT-1 is provided with electric heating. The electric heating is cut in and cut off with the switch arranged on the turret mount board, to the right side. The heating element of protection glass of the sight and the pilot lamp are switched on simultaneously with device TNPT-1.

The time of operation of the vision device electric heating at an ambient temperature below +5°C is not limited. At a temperature of up to +20°C the device heating can be switched on for 10 minutes maximum. At an ambient temperature above +20°C the use of heating is prohibited because the heating may lead to overheating and failure of the device. The device overheating is indicated by dots and spots of yellow and brown colour.

When in the travelling position, the inlet port of the TNPT-1 device seat should be closed with the shutter, the device heating should be cut off.

To remove device ТНПТ-1, it is necessary:

(a) to make sure that the electric heating is cut off;

(b) to detach the device plug connector;

(c) to turn off four fastening bolts;

(d) to remove the device together with a rubber gasket from the seat.

Place the device into the socket in the reverse procedure. In this case, remember that the terminal lug of the wire GROUND (КОРПУС) from the wires bundle running to device ТНПТ-1 should be put under the head of one fastening bolt.

Night vision devices of the driver (ТВНО-2Б) and the commander (ТКН-1С) are designed for viewing the road and terrain only during night driving.

These devices make it possible to see the objects illuminated by special spotlights - head lamps ФГ-125 of the driver's night vision device and by spotlight ОУ-3ГА-2 of the commander's night vision device. The image produced on the device screen is single-coloured (green) but of variable intensity.

In using the night vision devices, observe the following rules:

1. Do not allow incompetent personnel to handle the night vision devices.

2. Never use the night vision devices in the day-time.

3. Immediately close the blind when operation with the night vision device is over or when direct light of high intensity gets in the device.

4. Switch on the power-pack of device ТВНО-2Б only when the night vision device is properly connected.

5. Do not switch on the night vision devices when there is no need in that.

6. Do not use the night vision devices unless they are installed in their seats.

7. After operation, remove the night vision devices from their seats and stow them in the box.

8. Check functioning of the night vision devices in the day-time only with the diaphragm put on the upper head. When checking the night vision devices in dimly lit premises, it is permissible to completely open the diaphragm slots. If the sun is bright, the diaphragm slots must be not more than 1 mm wide. If outdoors in gloomy weather, the diaphragm slots should be half-open.

The night vision device is considered serviceable if in the process of checking in the day-time a greenish background appears in the field of view and the objects are more or less visible within the device viewing distance.

Do not keep the night vision device switched on in the day-time for more than 2 min. Then immediately switch it off and close the shutter.

The image converter tube of the night vision device can be light-struck through the eyepieces. Therefore, when checking the device in the day-time, protect the eyepieces from light.

9. Clean the outer surfaces of the device prisms as well as the light filters and reflectors of the head lamps and spotlight with a clean flannel cloth. Do not use for this purpose the waste intended for cleaning the device housing. When cleaning the optical glass surfaces, first blow off particles of sand and dust or remove them with a brush, then breathe upon the glass and wipe it with clean flannel making circular movements from the centre towards edges of the glass. When cleaning the glass, take care not to disturb the sealing putty in the glass-to-metal framing joint.

Do not touch the optical parts with fingers or with oily and dirty rags. When replacing the lamp in the spotlight and head lights, use clean cloth to wrap the bulb for the time of its placing in the holder, and to clean the reflector and lamp after replacement.

10. Clean the stowage boxes of dust, sand and dirt, whenever required, wipe the internal and external surfaces of boxes afterwards with lightly moistened waste and dry them up.

11. In case of prolonged storage of the devices in the cut-out state, once a year (in any season) or before operation cut in the devices for two hours to maintain their electric parameters within the specified range. Be sure to observe the rules outlined above.

Driver's Night Vision Device TBHO-2Б

The set of the driver's night vision device consists of:

1. Night vision device TBHO-2Б (Fig. 101).
2. High-voltage power pack.
3. Spare parts and accessories arranged in the device stowage box (Fig. 103).
4. Special head lamps with infrared filters.

In the operating position, night vision device TBHO-2Б is mounted in the seat provided in the front armour plate of the vehicle hull in front of the driver and secured to the seat by special clamps. The power pack of the driver's night vision device is installed beside the instrument panel, to the right of the driver.

Before mounting night vision device TBHO-2Б in place, remove pad 6 (Fig. 102) from clamp 3 upon giving the pad bolts several turns back. This done, disconnect the plug connector and pull vision device THПO-115 out of its seat. Put pad 6 and vision device THПO-115 into the stowage box of vision device TBHO-2Б.

To install night vision device TBHO-2Б in the operating position, proceed as follows:

1. Take the night vision device out of the stowage box and remove the diaphragm from the device head.
2. Use a clean flannel cloth to wipe the surface of the upper prism and eyepiece lenses.
3. Place vision device TBHO-2Б into the seat and secure it with clamps.

In this case the clamp of vision device THПO-115 is arranged in front of vision device TBHO-2Б.

4. Remove the cap from the power pack high-voltage cable lug.
5. Screw out the plug from the device high-voltage lead-in receptacle.
6. Screw the plug into the cap and put them into the stowage box.
7. Plug the high-voltage cable lug into the device and secure it by means of the union nut.
8. Connect the plug connector of the wire bundle of the heated vision devices.

To remove vision device TBHO-2Б, proceed in the reverse order.

Keep the upper prism and eyepieces of the vision device and the head lamps clean.

To put the TBHO-2Б night vision device into operation, proceed as follows:

(a) set power pack switch 2 (Fig. 102) on the ON position;

(b) switch on the head lamps of the TBHO-2Б night vision device (the pilot lamp in the speedometer case will glow) by using a switch located on the instrument panel;

(c) open the shutter.

Operation of the device is considered normal when:

- the specific whistling noise of the operating power pack can be heard when the engine is shut down;
- the uniform (non-flickering) greenish background is seen in the device screen when the power pack is cut in;
- the distinct image of the road and objects appears in the device field of view when the head lamps with infrared filters are cut in.

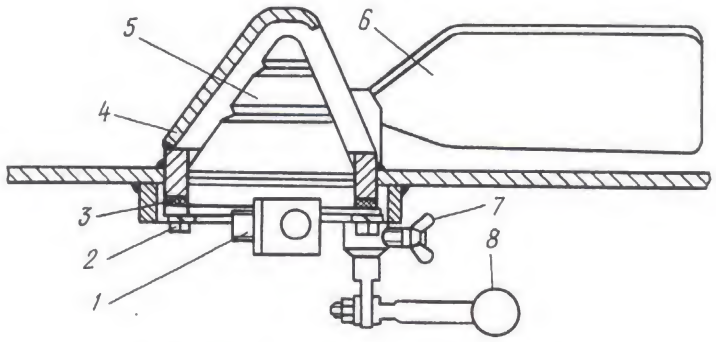


FIG. 100. INSTALLATION OF VISION DEVICE THIT-1

1 – plug connector; 2 – fastening bolt; 3 – gasket; 4 – socket; 5 – device THIT-1; 6 – shutter; 7 – retainer; 8 – shutter control handle

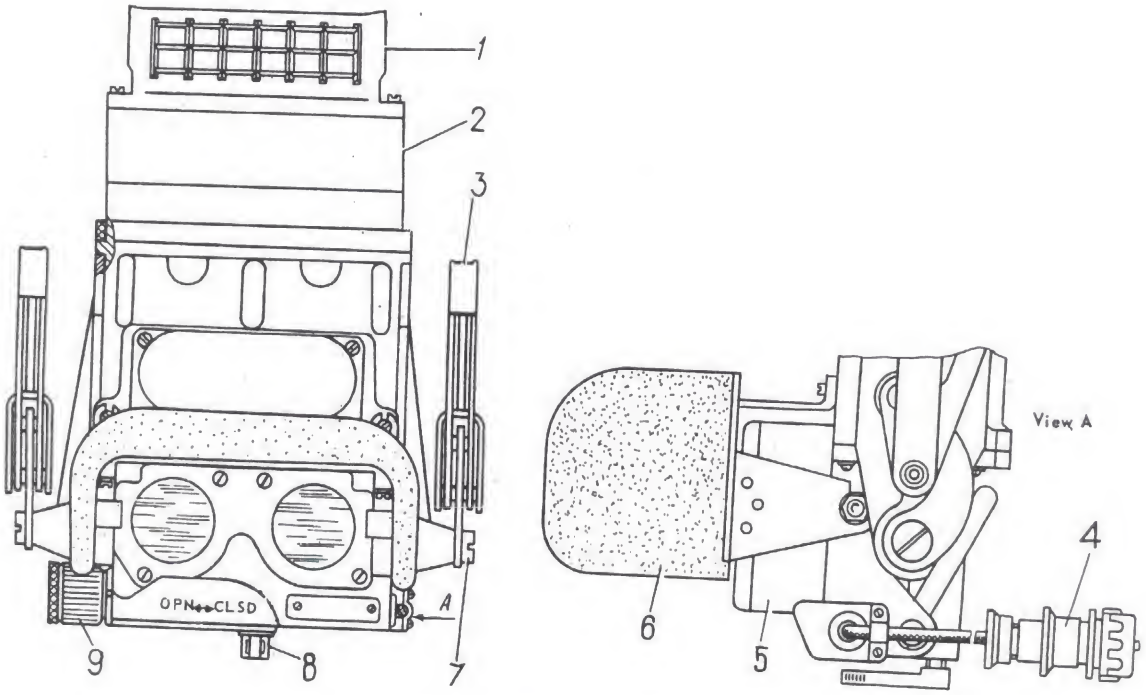


FIG. 101. DRIVER'S NIGHT VISION DEVICE TBHO-2S

1 – upper head; 2 – housing; 3 – clamp; 4 – plug connector; 5 – heating sleeve; 6 – headrest; 7 – screw; 8 – blind knob; 9 – plug of high-voltage lead-in

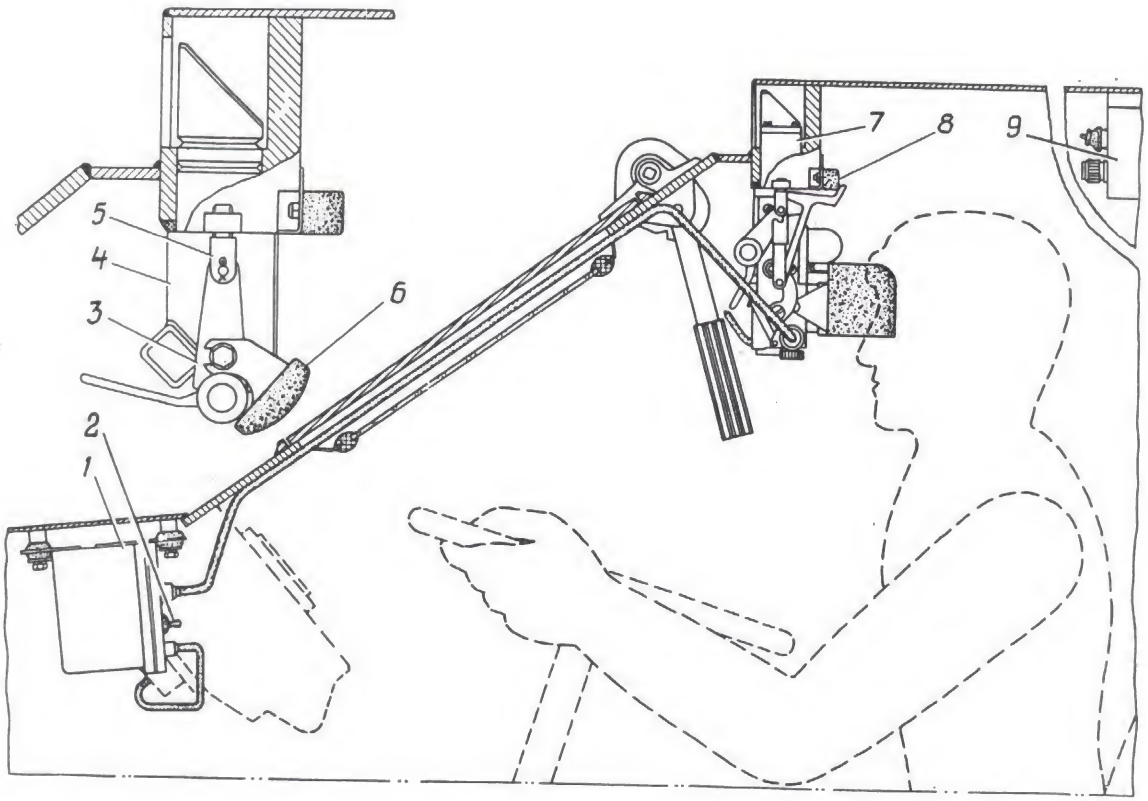


FIG. 102. INSTALLATION OF DRIVER'S VISION DEVICES

1 – power pack; 2 – switch; 3 – clamp of device ТНПО-115; 4 – vision device ТНПО-115; 5 – clamp yoke; 6 – pad; 7 – driver's night vision device ТВНО-2Б; 8 – headrest for vision device ТНПО-115; 9 – glass temperature regulator РТС-27-3А

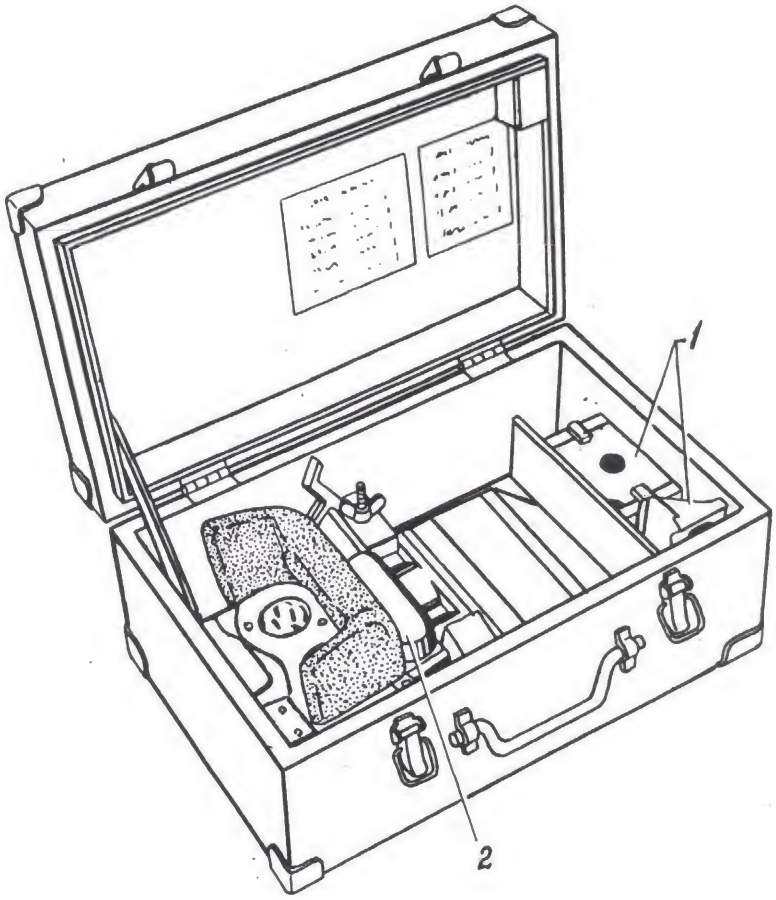


FIG. 103. STOWAGE OF NIGHT VISION DEVICE TBHO-2B
1 – SPTA set; 2 – night vision device TBHO-2B

Adjustment of the head lamps with infrared filters is performed at nightfall and with the pressure in tyres of 2.8 kgf/cm^2.

To adjust the head lamps, proceed as follows:

1. Station the vehicle on a level ground so that it does not impede traffic.
2. Set the night vision device in the operating position.
3. Install a small post or stake in front of the vehicle, in the prolongation of its axis, at a distance of 45 to 50 m from the vehicle.
4. Switch on the device and the head lamps with infrared filters.
5. Open the blind.
6. Give the nuts that fasten the head lamps several turns back.
7. Cover the LH head lamp. See through the night vision device and set the RH head lamp in the position providing for the best visibility of the post lower portion and the adjacent road. After adjustment, fasten the head lamp.
8. Cover the RH head lamp and adjust the LH one in the same manner. After adjustment, fasten the head lamp.

9. Check for the road visibility at a distance of 45 to 50 m with both head lamps cut in.

The night vision device is considered as functioning normally if at a distance of 15 m a person can be recognized by viewing the face and if the terrain in the vicinity is well seen.

Commander's Night Vision Device TKH-1C

The set of commander's night vision device consists of:

1. Night vision device TKH-1C (Fig. 104).
2. Spare parts and accessories arranged in the stowage box of the night vision device (Fig. 107).
3. Spotlight OY-3ГА-2 (Fig. 105).
4. Spare parts and accessories for the spotlight.

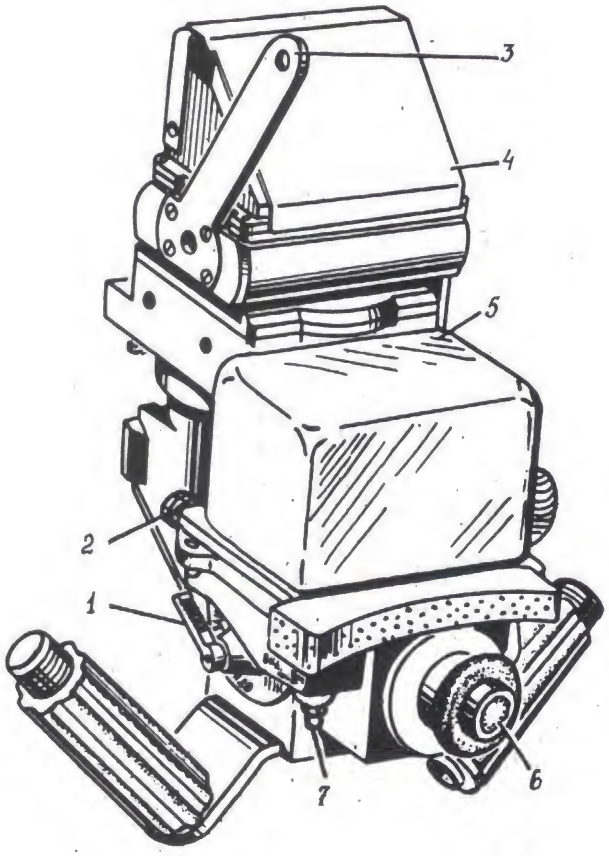


FIG. 104. COMMANDER'S NIGHT VISION DEVICE TKH-1C

1 – blind control lever; 2 – mains cable lead-in socket; 3 – bracket of rod coupling spotlight with night vision device; 4 – upper head with diaphragm; 5 – power pack; 6 – eyepiece eye shield cap; 7 – night vision device switch

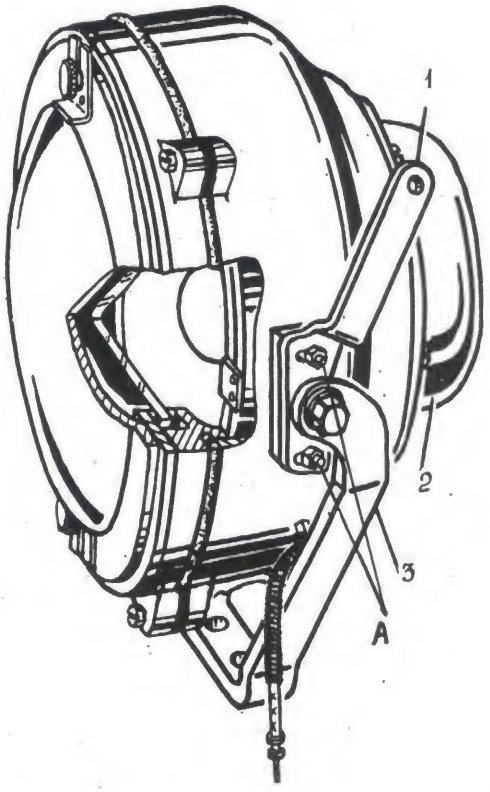


FIG. 105. SPOTLIGHT OY-3ГА-2 OF NIGHT VISION DEVICE TKH-1C

1 – bracket; 2 – spotlight; 3 – bracket for securing spotlight to vision device mounting shield; A – longitudinal slots in trunnion

In its operating position the TKH-1C night vision device is secured in the mounting shield at the front armour plate of the vehicle hull (Fig. 106) and is locked by retainers.

In its operating position spotlight OУ-3ГА-2 is secured by two bolts to the vision device mounting shield and can be traversed and elevated together with the vision device. In idle position, the spotlight is bolted to the vehicle floor plate.

The spotlight SPTA set is stowed in the vehicle SPTA set box secured in the auxiliary wheel bay on the right side.

To set the commander's night vision device in the operating position, proceed as follows:

1. Remove packing hood 6 (Fig. 106) of device TKH-1C from the stowage box and install it on the shield instead of packing hood 2 of device ТПКУ-2Б which should be placed into the box.

2. Remove the OУ-3ГА-2 spotlight from the stowage place and secure it to the commander's night vision device mounting shield with two bolts.

3. Remove vision device TKH-1C from the stowage box and take the diaphragm off the device head.

4. Use a clean flannel cloth to wipe the surface of the upper prisms and the eyepiece lens.

5. Pull down the device elevation retainers and turn their heads through 90°.

6. Remove device ТПКУ-2Б from the shield port.

7. Insert device TKH-1C into the shield port and release the retainers. See that the retainers fully enter the retainer holes in the device (mounting process for vision devices TKH-1C and ТПКУ-2Б is similar).

8. Connect spotlight rod 4 with the vision device. Insert the spotlight cable into terminal 7.

9. Remove the vehicle mains cable from the clip and connect it to the TKH-1C device.

10. Screw off commander's vision device mounting shield traverse lock 10.

11. Place device ТПКУ-2Б into the box.

To remove the TKH-1C vision device from its operating position, proceed in the reverse order.

For the time the commander's vision device is not in use, the eye shield of the eyepiece should be covered with a rubber cap.

Keep the upper prism, device eyepiece and spotlight clean. Clean the device shield of dust in summer and of snow in winter to ensure traversing of the vision device.

To put the TKH-1C vision device into operation, proceed as follows:

1. Switch on the TKH-1C vision device spotlight by means of SPOTLIGHT (ПРОЖЕКТОР) switch 8 (see Fig. 93) located on the instrument panel.

2. Set the knob of switch 7 (Fig. 104) to the ON position. Instantly the typical whistling noise of the operating power pack will be heard.

3. Align the optical axes of the vision device and spotlight, if necessary.

Alignment of the optical axes should be carried out by the vehicle commander and one of the crew members. The vehicle commander observes through the vision device and gives directions on tilting the spotlight to the crew member charged with the spotlight tilting.

The operations on alignment of the optical axes should be carried out at nightfall. To this end, with the tyre inflation pressure of 2.8 kgf/cm^2, do the following:

(a) station the vehicle on a level road section;

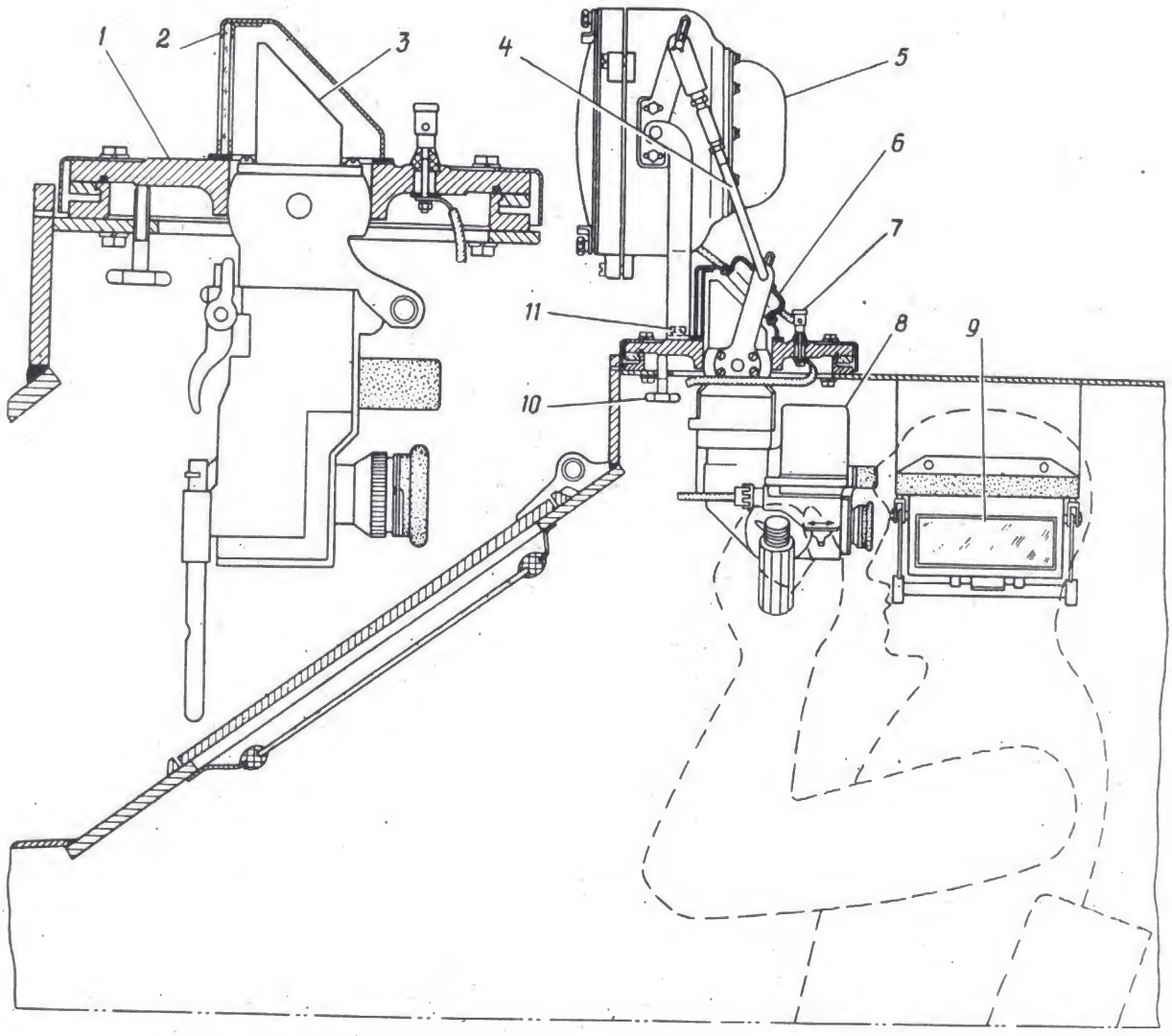


FIG. 106. INSTALLATION OF COMMANDER'S VISION DEVICES

1 – mounting shield; 2 – protective hood of vision device ТПКУ-2Б; 3 – vision device ТПКУ-2Б; 4 – rod; 5 – spotlight ОУ-3ГА-2; 6 – protective hood of night vision device ТКН-1С; 7 – terminal; 8 – night vision device ТКН-1С; 9 – vision device ТНП-Б; 10 – lock; 11 – spotlight bracket bolt

(b) switch on the commander's night vision device and the spotlight;

(c) slacken the lock nuts on rod 4 (see Fig. 106) connecting the spotlight with the vision device;

(d) select a ground feature at a distance of 250 to 300 m from the vehicle;

(e) aim the centre of the reticle in the field of view of the device at the selected ground feature and align the centre of the spotlight light spot with the same place of the ground feature. Tilt the spotlight in the vertical plane by changing the length of rod 4 through turning the rod sleeve. Horizontal shift of the spotlight is accomplished by making use of longitudinal slots A (see Fig. 105) in the trunnions. To this end it is necessary first to loosen the nuts securing the trunnions to the spotlight shell;

(f) keep the spotlight in the adjusted position and tighten the lock nuts on the rod and the nuts securing the trunnion straps.

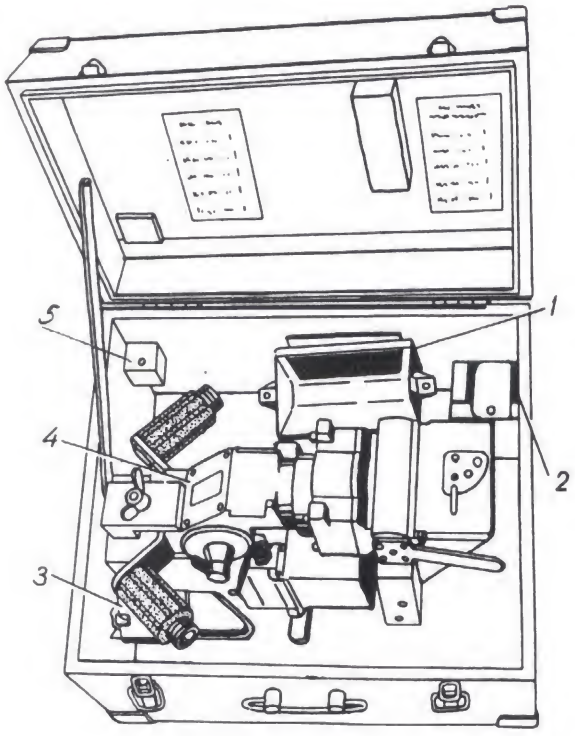


FIG. 107. STOWAGE OF NIGHT VISION DEVICE TKH-1C

1 – protective hood of vision device TKH-1C; 2 – SPTA set; 3 – head of vision device ТПКУ-2Б; 4 – night vision device TKH-1C; 5 – screwdriver

Lengthwise Focusing of Spotlight

When installing a new bulb in the spotlight taken from the SPTA set for the given vehicle or when replacing the reflector, perform lengthwise focusing of the spotlight with the aim of aligning the bulb glower with the real focus of the reflector. The lengthwise focusing is performed with the focusing device available in service SPTA set BK-41-3906235 (for 5 vehicles).

To perform focusing, proceed as follows:

1. Screw out three fastening screws of the spotlight and remove its cover.

2. Mount the focusing device on the spotlight, for which purpose:

(a) drive legs 3 (Fig. 108) of the focusing device into the holes of the disc of focus unit 2 as far as they go;

(b) use screws 6 and 7 to insert pins 5 inside focus unit 2;

(c) align the pin projections with the holes of the focus unit and turn spreader screw 6 to spread pins 5.

3. Loosen locking screw 4 and perform focusing by turning adjusting screw 7.

The spotlight is considered focused if a clear and bright light spot (8-shaped) is visually observed on the vertical screen located at a distance of at least 20 m from the spotlight.

4. After the focusing, tighten locking screw 4, remove the focusing device, and reinstall the cover.

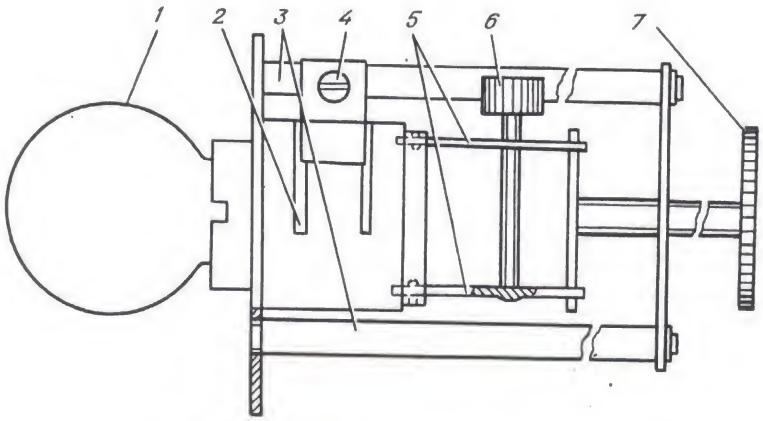


FIG. 108. LENGTHWISE FOCUSING OF SPOTLIGHT

1 – lamp; 2 – focus unit; 3 – leg; 4 – locking screw; 5 – pins; 6 – spreader screw; 7 – adjusting screw

Main Troubles of Night Vision Devices and Remedies

Trouble	Cause	Remedy
Device power pack is switched on (with engine not operating) but no typical whistling noise of operating power pack is heard and greenish background is not seen on device screen	Break of cable running from vehicle mains to device	Check cable for condition and eliminate break
	No contact in low-voltage connector	Restore contact in connector
	Wrong polarity in connection of vision device to vehicle mains	Check for proper connection of supply cable to vehicle mains
	Defective power pack: (a) burnt protective device in power pack circuit;	Replace protective device
	(b) bimetal protective device is cut off;	Cut in protective device
	(c) one of power pack transistors failed	Send device to special repair shop
Power pack functions normally but greenish background is not seen on device screen	Poor contact in high-voltage connector	Clean contacts with rectified alcohol, tighten up nuts of high-voltage leads-in
	Disruption of high-voltage cable insulation	Replace high-voltage cable
	Faulty image converter tube	Send device to special repair shop
Greenish background is seen on vision device	Closed blind of device	Set blind knob ir position OPEN (OTKP.)

Continued

Trouble	Cause	Remedy
screen but no image of road, ground features and terrain is visible	Faulty head lamps or fault in head lamps supply circuit	Repair head lamps (supply circuit)
	Short circuited or broken spotlight cable	Eliminate trouble
	Blown spotlight bulb	Replace bulb with a spare one
	Misalignment of spotlight and vision device optical axes	Align optical axes of spotlight and vision device
With head lamps (spotlight) switched on, bright light spots are seen through light filter	Damaged film of infrared light filter or broken filter	Replace infrared light filter with a spare one. If a spare filter is not available, coat light slots with black paint
Image seen in vision device is dim and blurred	Dirty outer surface of prism	Wipe outer surface of prism with clean flannel cloth
	Dirty or fogged eyepiece lenses	Wipe lenses with clean flannel cloth
	Partial misalignment of light beam of head lamps (spotlight) and vision device	Align optical axes of head lamps (spotlight) and device
	Insufficient voltage supplied from power pack to image converter tube	Send device to special repair shop for checking power pack
	Improperly installed bulb in spotlight	Install bulb properly, i.e. insert largest prong (retainer) of bulb into respective largest slot in bulb holder, and then turn bulb clockwise as far as it will go
	Decreased light intensity of spotlight bulb (bulb became dark)	Replace bulb with a spare one
	Unfocused spotlight	Carry out focusing of spotlight
Upper head of device swings when even slight effort is applied	Loose head fastening screws	Tighten screws
Upper prism is chipped and cracked	Mechanical damage	Replace prism with a spare one
Prism is not being heated. Eyepieces are heated normally	No contact	Press heating system sleeve close to terminal block of lower head

Continued

Trouble	Cause	Remedy
Prism and eyepieces are not being heated	Broken wires of prism heating	Send device to special repair shop
	Broken adjusting resistor circuit	Send device to special repair shop
Eyepieces and prisms are being overheated above permissible limits	Broken thermistor circuit	Send device to special repair shop

Chapter 11

SPECIAL EQUIPMENT

WINCH

The winch is installed in the front portion of the vehicle on the brackets welded to the hull.

For using of the winch, the vehicle has two hatches: the wire rope hatch with guide rollers 19 (Fig. 109) secured at the hatch edges in the front lower plate, and the hatch in the deck above the winch providing access to the wire rope hatch lock and used for maintenance of the winch. The lever of the drum sliding clutch is accessible through the hatch in the winch guard from the commander's seat.
The winch is driven by power take-off 10 of transfer case 9. Four forward speed gears ensure winding of the winch wire rope, and the reverse speed gear of the gearbox ensures unwinding of the winch rope. Winch drum 5 (Fig. 110) is mounted free on the shaft of the worm reducer. Torque is transmitted from the shaft to the drum by means of dog clutch 4. The winch wire rope is steel, 30 m long. One end of the wire rope is secured to the drum by means of a U-bolt. The winch reducer is worm-type. Its transmission ratio is 23.

Torque is transmitted to the winch by two propeller shafts provided with an intermediate bearing. To prevent the winch from overloading, the propeller shaft and the intermediate shaft are coupled with safety pin 8 (Fig. 109).

To accomplish self-recovery of the vehicle by means of the winch, proceed as follows.

1. Open cover 4 of the winch upper hatch.
2. Open cover 18 of the wire rope hatch.
3. Open the hatch of the drum clutch lever.
4. Start the engine.
5. Engage the winch power take-off and set the transfer range lever in the neutral position.
6. Depress the clutch pedal.
7. Set the gearbox gear-shift lever in the reverse speed for unwinding the wire rope.
8. Slacken the wire rope, set the gear-shift lever in the neutral position, disengage the drum clutch and unwind the wire rope by pulling it manually to the object which the vehicle will be drawn to. See that at least 3 or 4 turns of wire are left on the drum. Attach the wire rope to the object. Choose such a position for the wire

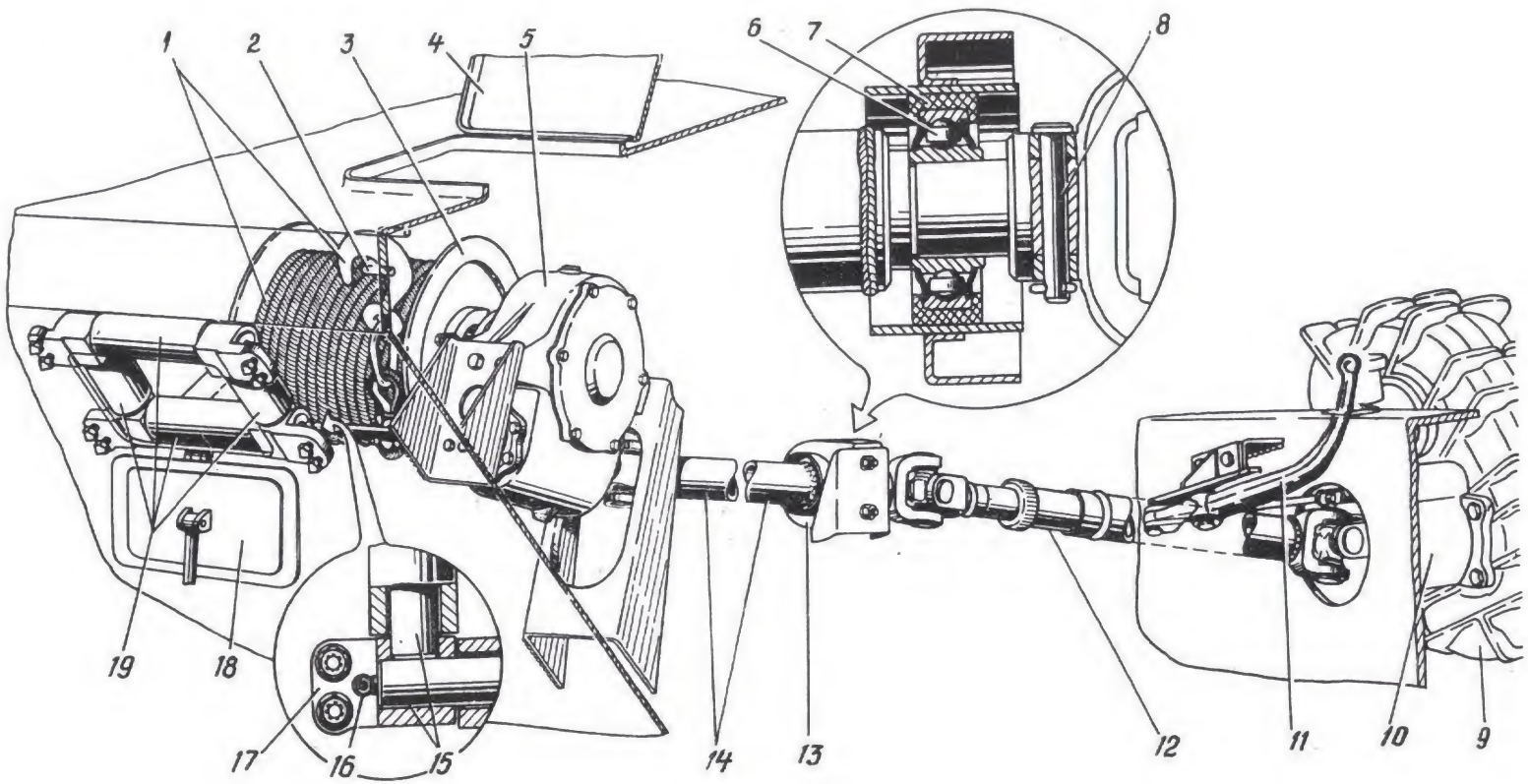


FIG. 109. WINCH MOUNTING

1 – wire rope with hook; 2 – hook clip; 3 – drum; 4 – winch hatch cover; 5 – reduction gear case; 6 – ball bearing; 7 – rubber bushing; 8 – safety pin; 9 – transfer case; 10 – power take-off; 11 – lever; 12, 14 – propeller shafts; 13 – propeller shaft intermidiate bearing; 15 – guide roller axles; 16 – lubricator fitting; 17 – guide roller axle bracket; 18 – wire rope hatch cover; 19 – guide rollers

rope attachment that the direction of towing is aligned with the vehicle longitudinal axis.

Whenever necessary, the winch rope can be made 20-m longer by using the wire rope intended for tugging of the vehicle on water. The ropes are connected with a special coupling link available in the vehicle SPTA set.

9. Engage the winch drum clutch.

10. Depress the vehicle clutch pedal, shift in the first speed gear and operate the engine at medium speed.

In the process of the vehicle self-recovery, it is permissible to engage the low-range gear. To slacken the wire rope, shift in the reverse speed gear. When using the winch, see that the wire rope is correctly wound on the drum and no kinks or knots take shape on the wire rope.

Engage the winch only with the engine running idle at low speed. In case of safety pin shearing, immediately disengage the winch, otherwise the winch intermediate propeller shaft yoke may get seized. A typical symptom of the safety pin shearing is an increase of the engine speed without throttle opening and ceasing of the wire rope winding. Sometimes the pin shearing is accompanied by a typical click.

To disengage the winch quickly, depress the clutch pedal and set the gear shift lever in the neutral position.

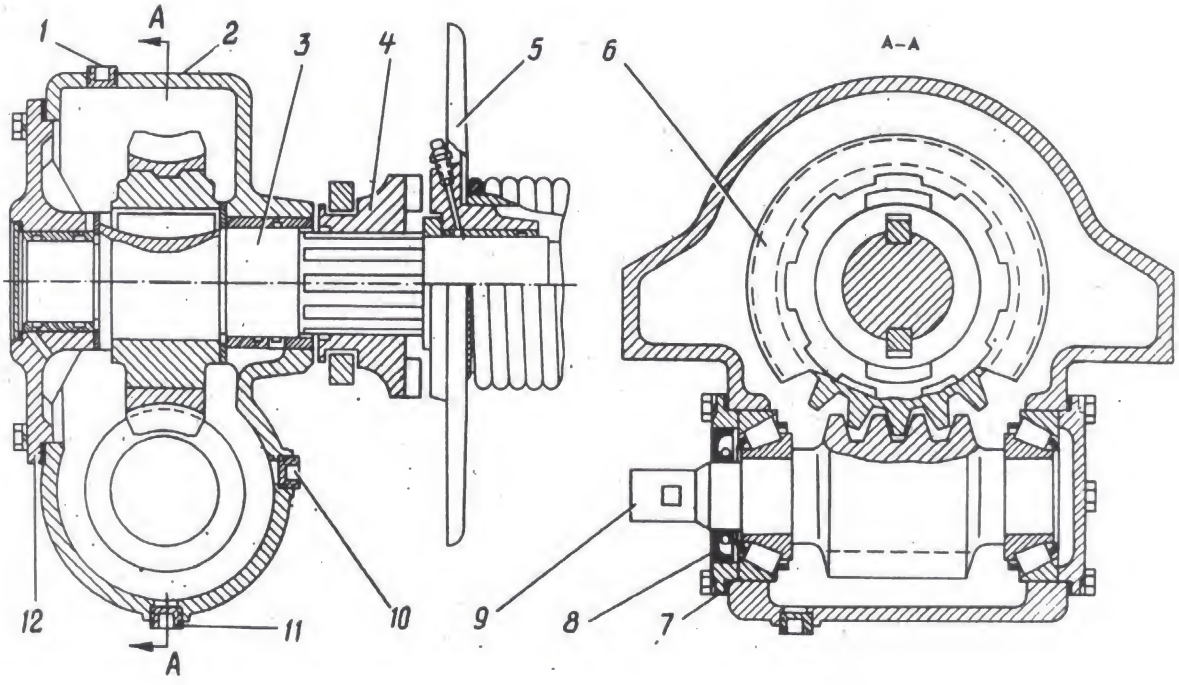


FIG. 110 WINCH

1 – oil filler hole plug; 2 – reduction gear case; 3 – winch shaft; 4 – drum clutch; 5 – drum; 6 – gear; 7 – bearing cap; 8 – oil seal; 9 – worm; 10 – oil level check plug; 11 – oil drain plug; 12 – reduction gear case cover

D o n ' t

1. Never use the winch wire rope for vehicle towing.

2. Never engage the transfer when unwinding the wire rope (when the reverse speed is engaged).

3. Do not stay near the wire rope or correct the laying of the wire rope on the drum when the winch is operating.

4. Do not use bolts or other objects instead of the safety pin.

5. Never use the parking brake when the winch is operating.

6. Do not draw the wire rope across the road as passing vehicles may run into it. If there is no way but putting the wire rope across the road, post a guard or prohibitory road signs on the road, and then proceed.

C a r e o f W i n c h

Every 6000 km of run, proceed as follows:

(a) change oil in the winch housing;

(b) lubricate the bearings of the winch drum and shaft;

(c) lubricate the splines of the drum sliding clutch;

(d) clean the winch rope of sand and dust and lubricate it with oil used for the engine.

After 15,000 km of run:

(a) lubricate hinged joints of the winch propeller shafts;

(b) lubricate the axles of the winch rope guide rollers.

FILTER-VENTILATOR UNIT

To protect the crew from toxic agents and radioactive dust in a contaminated area, the vehicle is provided with a system for cleaning of air supplied to the fighting and driving compartments and building of excessive pressure therein. For this purpose, the vehicle hull is made airtight, and the vehicle is equipped with a filter-ventilator unit (ФВУ) which is located in the engine compartment. It consists of a special blower, a distributing box, an absorbent filter and air ducts.

The special blower (Fig. 111) is a centrifugal air pump intended for inertia air cleaning. The special blower is installed in the engine compartment on the left side, near the engine bulkhead. The intake branch pipe of the special blower, protected by an armoured hood, is located in the left-hand rear portion of the turret flange.

Dust separated by the special blower is directed through a special pipe into the casing of the engine cooling system fan whence it is ejected from the vehicle by air flow.

The air branching system which delivers air to the fighting compartment is connected to distributing box 1 installed on special blower 2 (Fig. 112). The system includes an absorbent filter, type ФПТ-100М, used for cleaning of air of toxic agents or radioactive substance.

Distributing box 1 serves to direct air from the special blower to absorbent filter ФПТ or to the by-pass line. The distributing box valve is controlled with the knob installed on the engine bulkhead.

Valve control knob 5 can be set in two operating positions:

Position I: the knob is pushed right home. In this case air is directed to the by-pass line.

Position II: the knob is pulled right off. In this case air is directed to the absorbent filter.

The filter is engaged only when necessity arises to clean air of toxic agents or radioactive substance. It is permitted to turn on the filter for a short while (5 or 10 minutes) for checking the system after the filter is installed.

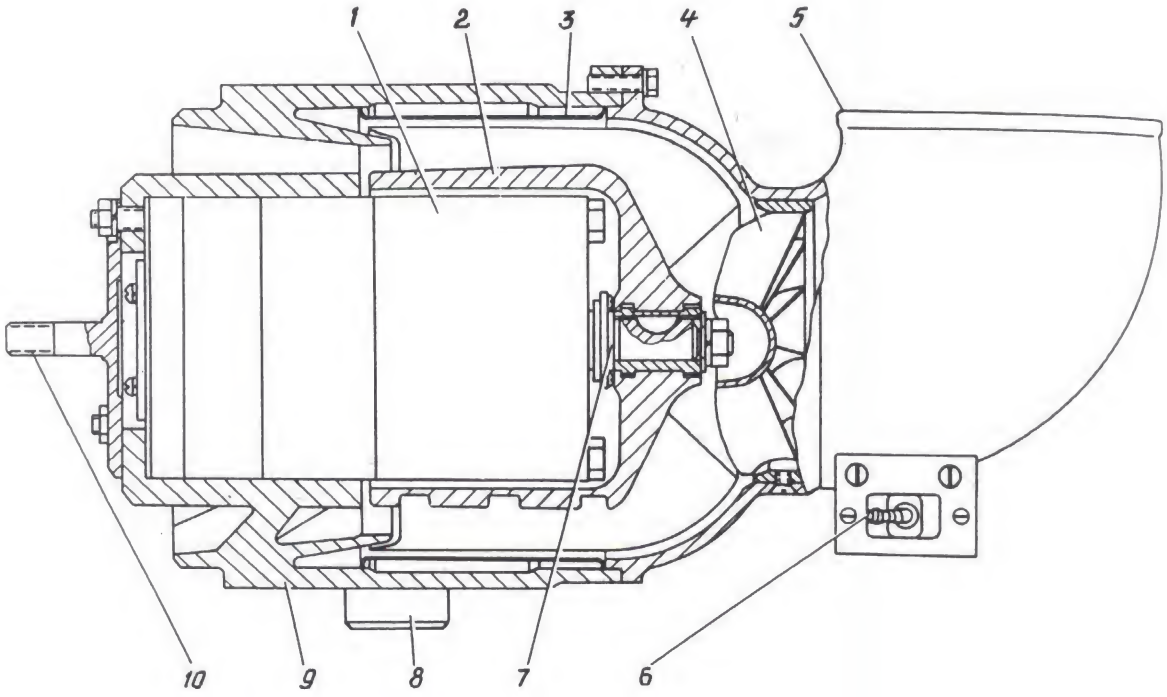


FIG. 111. SPECIAL BLOWER

1 – electric motor; 2 – rotor; 3 – ring for air cleaning; 4 – swirler; 5 – intake branch pipe; 6 – switch; 7 – shim; 8 – outlet branch pipe; 9 – special blower housing; 10 – tailpiece

The absorbent filter is replaced with a new one in the following cases:

(a) when carrying out decontamination upon leaving the contaminated area;

(b) when toxic agents or radioactive substances are detected inside habitable compartments of the vehicle inspite of overpressure;

(c) when black dust is detected in line 8;

(d) when dents, more than 8 mm deep, or punctures are found on the filter housing.

In case the filter is to be replaced, dismount it with the engine bulkhead doors closed, through the side and upper hatches of the engine compartment. Inspect the new filter before installing it on the vehicle. The filters having dents which are more than 8 mm deep or punctures must not be installed.

To install absorbent filter ФПТ-100М in the vehicle, proceed as follows:

(a) remove stoppers from the filter inlet and outlet holes. Never screw out the bolts inside the inlet hole flange on the cover or the nut on the filter bottom.

When installing the filter, protect its housing from impacts or other damage. See that no water, oil and other fluid get inside the filter;

(b) secure the absorbent filter to bracket 12 with clamps and bolts;

(c) secure coupling branch pipes 9 to the filter flanges with bolts 15. Use rubber packings to seal the joint. Check the special blower for operation and the habitable compartments for overpressure first when forcing air through the filter and then through the by-pass line.

To force air through the filter, pull back distributing box valve knob 5, remove stopper 10, open the inlet valve of the intake branch pipe by using handle 4, lock the handle in the lowermost position, and start operating the special blower. Overpressure in the habitable compartments must be at least 30 to 35 mm H_2O.

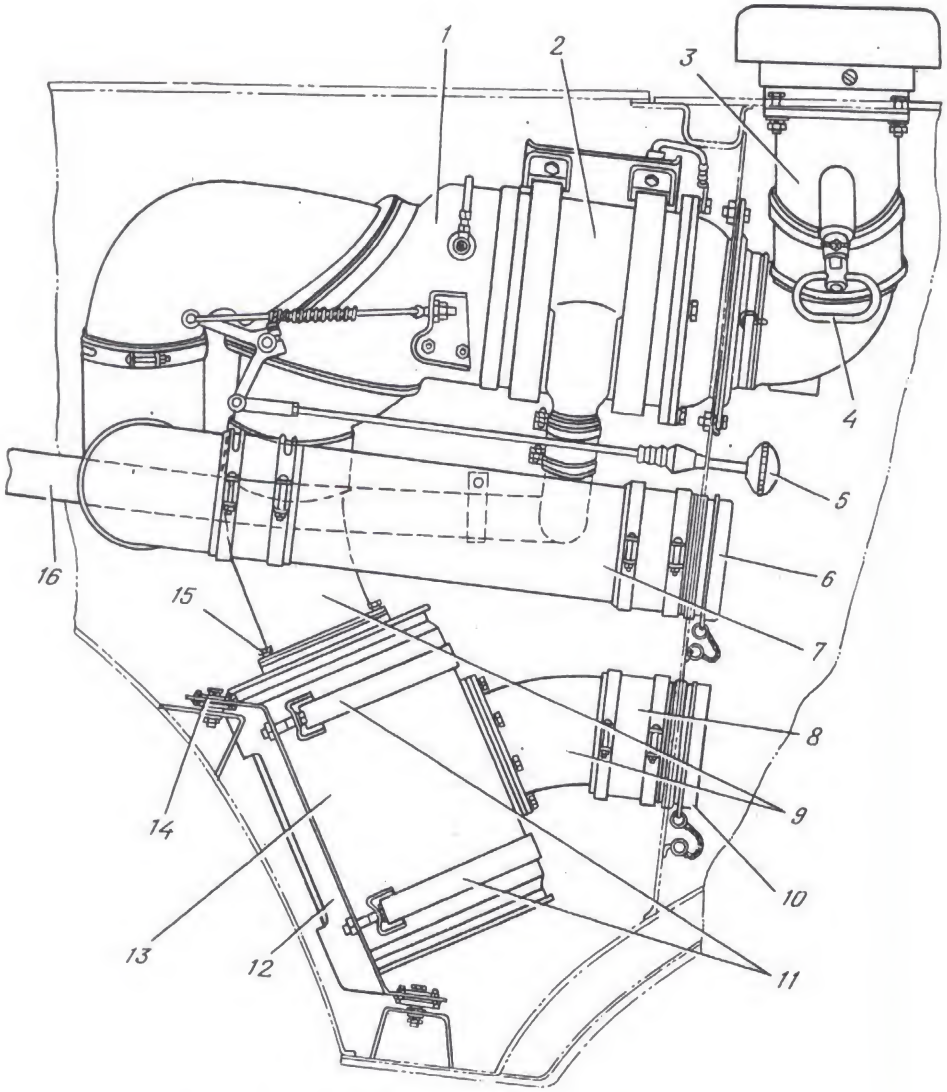


FIG. 112. FILTER-VENTILATOR UNIT

1 – distributing box; 2 – special blower; 3 – intake branch pipe; 4 – handle of inlet valve; 5 – distributing box valve control knob; 6, 10 – air line stoppers; 7 – by-pass line pipe; 8 – line delivering air through filter ФПТ; 9 – coupling branch pipes; 11 – clamps; 12 – bracket; 13 – absorbent filter ФПТ-100М; 14 – shock absorber; 15 – bolt; 16 – dust discharge pipe

To deliver air with the special blower through the by-pass line, push knob 5 right home, open stopper 6, open the inlet valve of the intake branch pipe with handle 4 and engage the special blower.

Upon checking the system, turn off the special blower, close the inlet valve with handle 4, reinstall stoppers 6 and 10 on the engine bulkhead and push knob 5 right home.

CAUTION!
1. When operating the special blower jointly with the filter, close all the hatches in the fighting and driving compartment tight by all means.
2. When in storage or when operating the vehicle with the special blower turned off, keep the inlet valve of the intake branch pipe and stoppers 6 and 10 closed to protect filter ФПТ-100М from premature failure. Knob 5 must be pushed right in.
3. To preserve the filter when air is forced by the special blower through the by-paas line, keep stopper 10 closed.
4. When storing or operating the filter, fill in Sections VI and VII of the Certificate accompanying each filter.

5. When operating or storing the vehicle, periodically check the brake valve for tightness, see that packings of the hatches, doors, engine bulkhead and flooring are in proper condition.

Measure overpressure in the habitable compartments of the vehicle after 6000 km of run. If the overpressure is less than the above mentioned valve, check the hull for tightness and tighten the detected loose joints.

In this case be sure to check:

(a) packings and locks of the driver's and commander's hatch covers and the covers of the hand arms firing ports;
(b) packings and locks (clamps) of the covers over the gearbox and transfer case sections;
(c) packings of the engine bulkhead;
(d) tightness of the brake valve, condition and attachment of the protective hood on both sides, and cover-to-hull tightness;
(e) tightening of the winch (upper and lower) hatch cover bolts and the service brake master cylinder;
(f) whether the turret shield packing hole is plugged;
(g) whether the drain holes and kingston valves in the hull bottom are plugged.

Overpressure in the habitable compartments is measured with a special device: piezometer. This is not supplied by the Manufacturer.

The simplest piezometer shown in Fig. 113 can be manufactured by a using military unit. It consists of two glass pipes 3 interconnected by rubber hose 5 and secured to wooden or textolite board 4 by clips. One of the pipes is fitted with rubber outlet hose 2 used for communication of the piezometer with atmospheric through one of the holes in the vehicle hull. Overpressure is read on the scale graduated in mm. The scale may be drawn on the board near the pipe or on the pipe proper.

To use the piezometer, pour slightly coloured water in one of pipes 3. See that the water level is at "0" when the piezometer is in the vertical position.

Used as the hole for the outlet hose in the piezometer shown in Fig. 113 is the hole for the bolt securing the spotlight bracket.

In case the outer diameter of outlet hose 2 is somewhat smaller than that of the hull hole, use modelling clay or putty to ensure tightness.

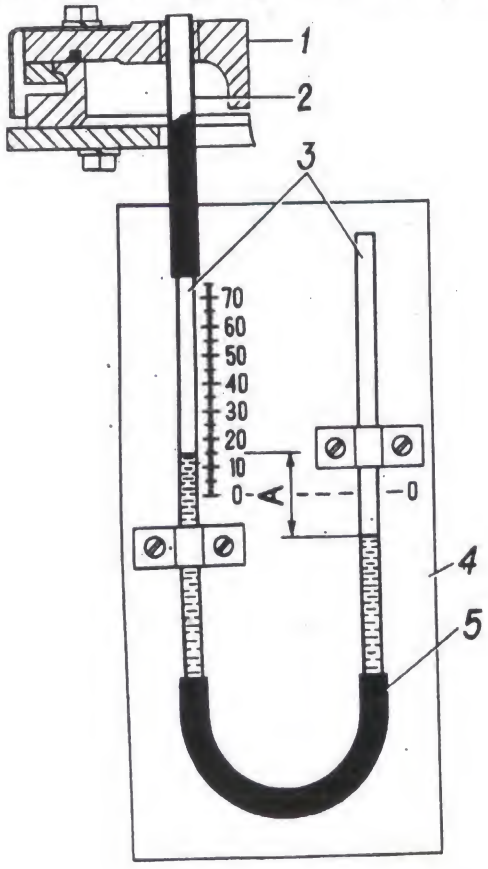


FIG. 113. INSTRUMENT FOR MEASURING OVERPRESSURE (PIEZOMETER)

1 – commander's vision device mounting shield; 2 – outlet hose; 3 – glass pipes; 4 – piezometer board; 5 – connection hose; A – minimum permissible overpressure when forcing air through absorbent filter (15+15 = 30)

PERSONNEL HEATER AND WINDSHIELD DEFROSTER

The vehicle is equipped with plenum-type personnel heater 4 (Fig. 114) installed inside the vehicle, to the left of the driver's seat. The heater blower fitted on the shaft of a two-speed electric motor circulates air through heat exchanger 2.

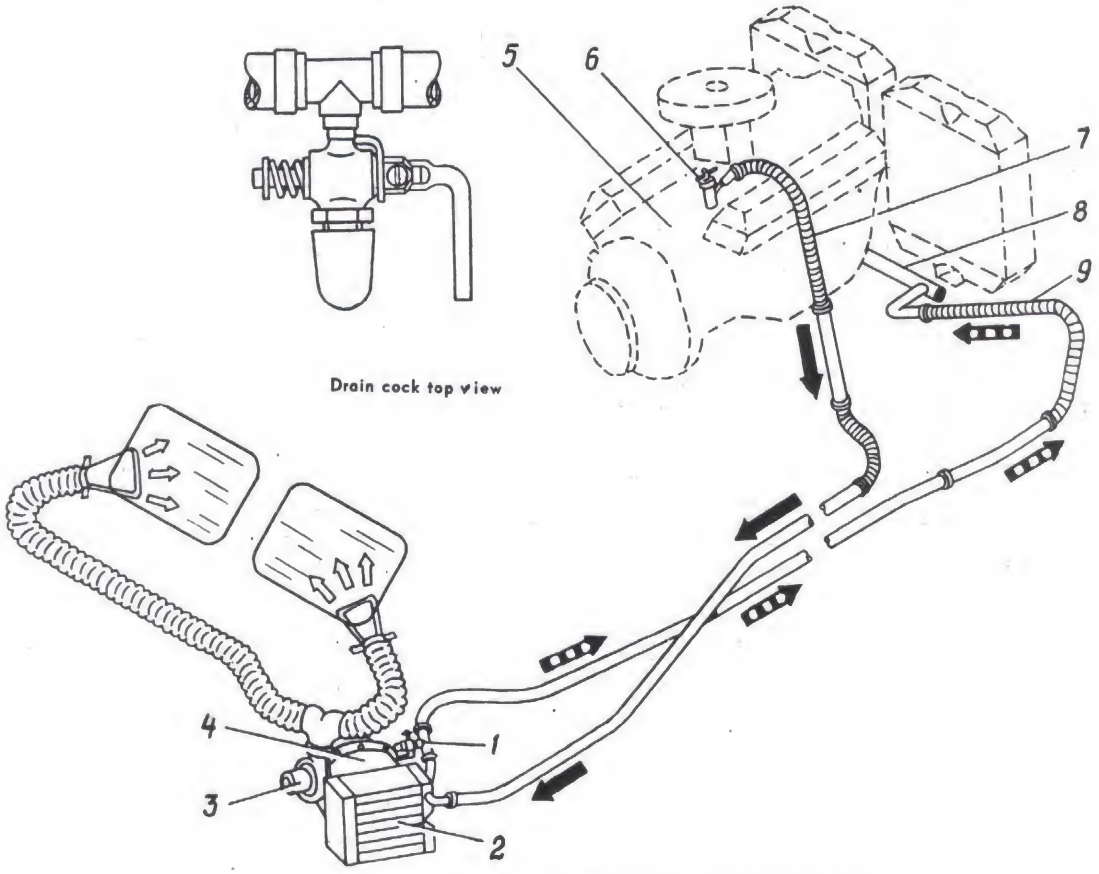


FIG. 114. VEHICLE HEATING AND WINDSHIELD DEFROSTER SYSTEM

1 – drain cock; 2 – heat exchanger; 3 – windshield defroster electric motor; 4 – heater; 5 – engine; 6 – shutoff cock; 7 – delivery hose; 8 – pipe running from heat exchanger to water pump; 9 – outlet hose

The heated coolant enters the heat exchanger from the engine cooling system through delivery hose 7. Flow of coolant is regulated by shutoff cock 6 located on the engine intake manifold.

If the coolant is water, the cock must be opened only after the engine is warmed up to prevent entry of cold water in the heat exchanger of the personnel heater and its freezing in it. A special motor-driven blower draws the heated air from the heater through corrugated hoses and delivers it to the vehicle windshields for defrosting.

The blower is cut in/out by a switch located on the instrument panel. For efficient operation, the personnel heater should be cut in only after the engine is warmed so that the temperature of coolant is as high as 80°C.

In summer, with shutoff cock 6 closed, the heater blower may be used for circulating the air inside the vehicle.

When draining coolant from the cooling system, first open heater drain cock 1 located on the front left-side wheel bay.

To ensure normal operation of the personnel heater and to prevent the blower blades from rubbing against the spokes of the electric motor flange and rods of the

blower guard, make sure that at least 3-mm clearances are provided there, and tighten up the screw securing the blower to the electric motor shaft.

Clean the cocks and check the condition of pipes every autumn.

RADIATION AND CHEMICAL DETECTION DEVICES

Roentgenometer

Roentgenometer, type ДП-3Б, (Fig. 115) is designed for measuring the intensity of gamma radiation where the roentgenometer sending unit is positioned. The instrument is capable of measuring the gamma radiation dose rate within the range of 0.1 to 500 R/h. The range is subdivided into four bands. The instrument error is ±10 per cent, max.

The roentgenometer is installed so that its readings can be simultaneously observed by the commander, driver and a member of the crew sitting behind the vehicle commander's seat.

The metal framing of the ДП-3Б roentgenometer is secured to the bracket installed on the front right-side wheel bay. The instrument framing is fitted with rubber shock absorbers that make attachment of the instrument during cross-country driving more

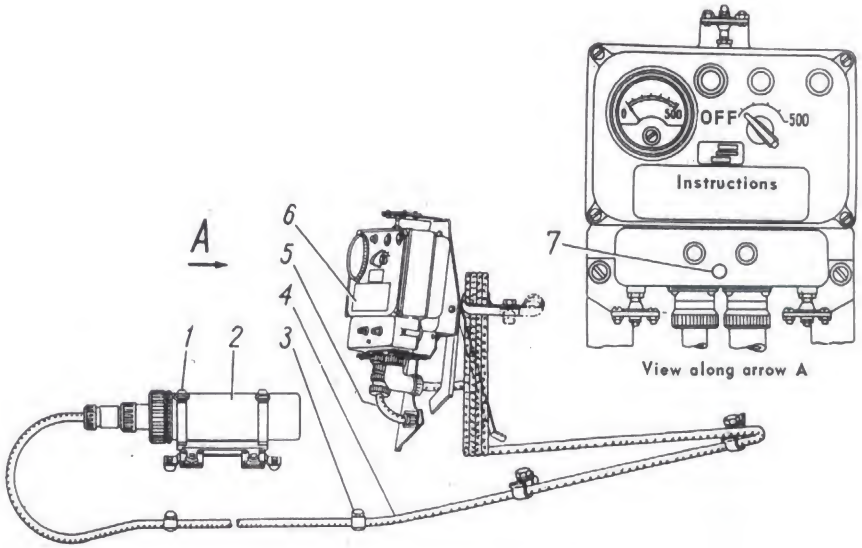


FIG. 115. INSTALLATION OF ROENTGENOMETER ДП-3Б

1 – sending unit clamp; 2 – sending unit; 3 – clip; 4 – cable; 5 – roentgenometer cable; 6 – roentgenometer ДП-3Б; 7 – check button

reliable. Roentgenometer sending unit 2 is mounted on the front lower plate. The unit is connected with the roentgenometer by cable 4 held by clips 3.

The ДП-3Б roentgenometer is fed by the vehicle mains. It is connected to the latter by cable 5 which is plugged in the bracket connector.

When the vehicle is on march, the roentgenometer should be kept covered. Description and operation of the roentgenometer are explained in the roentgenometer Instructions stowed in the bag on the driver's seat back.

When measuring the radiation intensity with the ДП-3Б roentgenometer, take into account the radiation attenuation factor for the vehicle hull. To determine the radiation intensity outside the vehicle, multiply the readings of the roentgenometer by the attenuation factor which is 2 for the БРДМ-2 vehicle.

Field Chemical Agent Detector Kit

The field chemical agent detector kit (Fig. 116) is used for general or specific detection of poisonous chemical agents.

The detector kit box is arranged on the right side of the vehicle superstructure (hull upper portion). Its attachment is so designed that the detector kit box can be quickly taken out.

The detector kit can be used both outside and inside the vehicle. For convenience in carrying the detector kit when the latter is used outside the vehicle, it has a shoulder strap.

When using the detector kit inside the vehicle, the box should be taken out and opened. No special place for installation of the kit box is envisaged in the vehicle. It may be held in one's lap or any vacant place.

The regulations for using the field chemical agent detector kit are set forth in the Instructions found in the detector kit box.

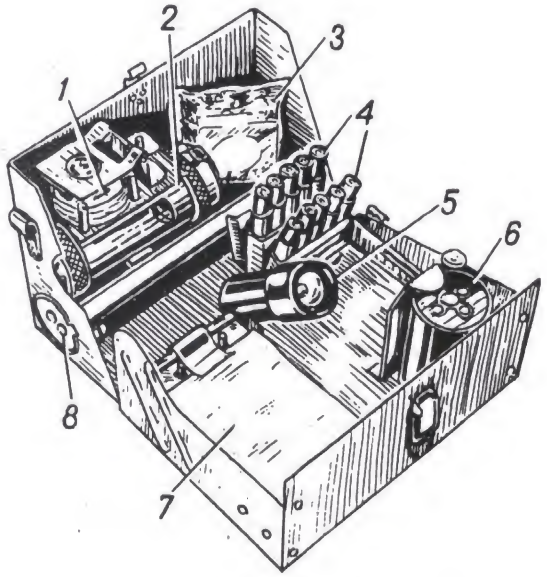


FIG. 116. FIELD CHEMICAL AGENT DETECTOR KIT

1 – caps for adapter; 2 – pump adapter; 3 – smoke filter; 4 – cartriges for heater; 5 – flash-light; 6 – heater housing; 7 – tubes in magazines; 8 – pump

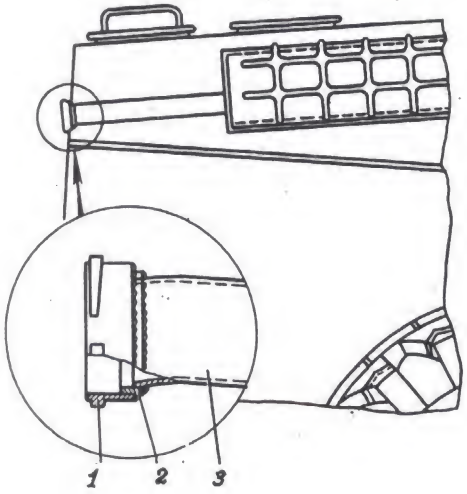


FIG. 117. MUFFLER WITH ADAPTER RING

1 – nipple; 2 – adapter ring; 3 – muffler exhaust pipe

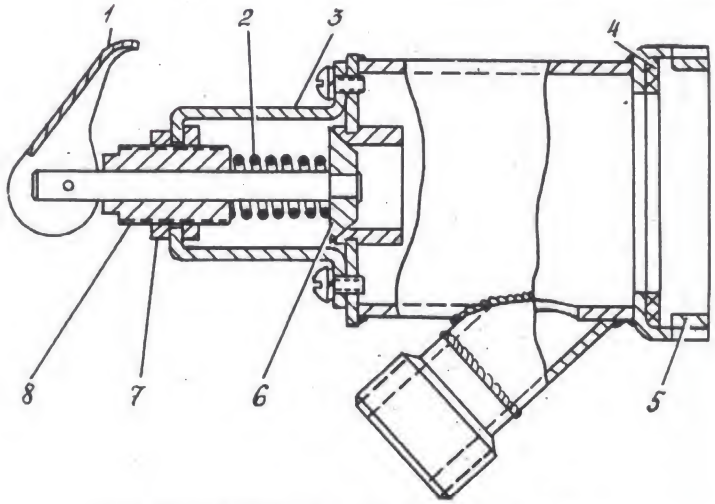


FIG. 118. SAFETY VALVE AND EXHAUST OFFTAKE

1 – lever; 2 – spring; 3 – body; 4 – gasket; 5 – cap; 6 – valve; 7 – nut; 8 – bushing

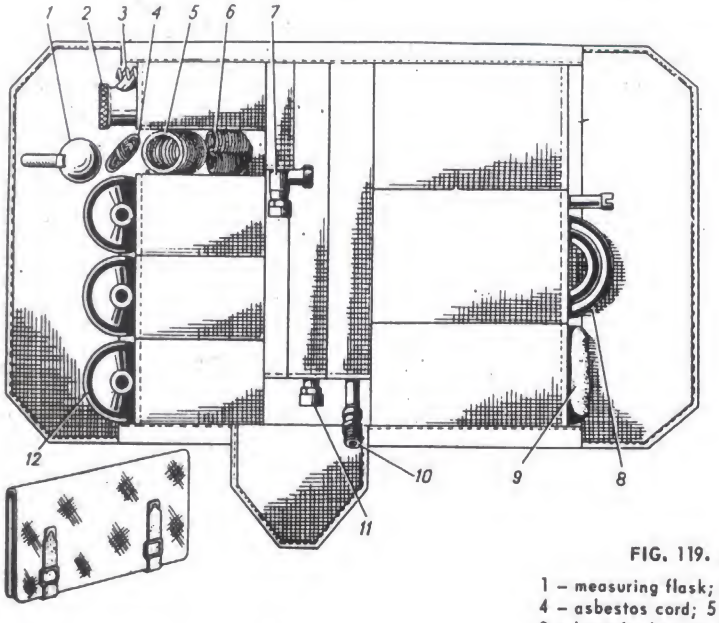


FIG. 119. ARRANGEMENT OF SET ДК-4Б IN BAG

1 – measuring flask; 2 – safety valve with exhaust off-take; 3 – spare spring; 4 – asbestos cord; 5 – gaskets (10 pcs); 6 – gaskets (36 pcs); 7 – ejector; 8 – hose for liquids; 9 – powder СФ-2 in bag; 10 – nozzle; 11 – extension piece; 12 – brush (3 pcs); Shown below is a folded bag

SET ДК-4Б FOR SPECIAL TREATMENT OF VEHICLE

The ДК-4Б vehicle-borne decontamination set is intended for special treatment of vehicle БРДМ-2 and of weapons and equipment carried by or mounted on the vehicle.

Radioactive and chemical decontamination and disinfection of the vehicle, weapons and equipment is performed both in summer and in winter by gas liquid ejection with water solution of powder СФ-2. The set also permits radioactive decontamination of dry non-greased surfaces by vacuum cleaning.

The decontamination set includes: gas liquid ejection device, deactivation powder СФ-2, spare parts and accessories, and stowage and shipment bags. Besides, the vehicle manufacturing plant supplies for the set the safety valve with exhaust offtake (Fig. 118) which is a component part of the exhaust offtake device.

The gas-liquid ejection device is actuated by the exhaust offtake device which is mounted on the right-side muffler exhaust pipe. This device is intended to receive exhaust gases of the engine and to maintain in the exhaust system the pressure required for decontamination of the gas-liquid ejection device.

The exhaust offtake device includes nipple 1 (Fig. 117) with adapter ring 2 which is connected to the safety valve combined with the exhaust offtake (Fig. 118) for the period of operation of the decontamination unit.

The safety valve is designed to shut-off the right side muffler exhaust pipe and thus maintain the pressure in the exhaust system of 0.8 to 0.9 kgf/cm^2. The exhaust offtake directs the flow of exhaust gases from the vehicle's running engine into the ejector of the gas liquid ejection device.

In daily operation of the vehicle,the safety valve and the exhaust offtake should be kept in the bag of the ДК-4Б decontamination set.

Leakage of exhaust gases through loose joints brings about the necessity to increase the engine speed in order to maintain the required pressure in the exhaust system needed for normal operation of the gas-liquid device. Therefore, for sealing the intake and exhaust pipe connections with the muffler, use is made of asbestos cord available in the ДК-4Б decontamination set.

The ДК-4Б decontamination set is kept in special bag 5 (Fig. 120) attached by a strap to the left-hand bottom plate in the bay close to the left-side front auxiliary wheel. The gas liquid ejection hose placed in bag 6 is kept jointly with the ДК-4Б decontamination set.

Prior to handling the gas liquid ejection device make sure the safety valve is properly adjusted and the exhaust system is properly tightened. Under these conditions the normal functioning of the gas liquid ejection device is ensured by the stable operation of the engine at a crankshaft speed of 2500 to 2800 r/min.

During treatment of the vehicle or other equipment by gas liquid ejection with decontamination set ДК-4Б, the vessel with solution must be installed at a height of 1300 mm from the road level.

Detailed description and operation of decontamination set ДК-4Б are outlined in special Instructions found in the set bag. Arrangement of the decontamination set is shown in Fig. 119.

ARRANGEMENT OF STANDARD INDIVIDUAL EQUIPMENT OF CREW

The standard individual equipment of the crew (rucksacks, each with an attached antigas kit) is arranged inside the vehicle:

1. Driver's rucksack 1 (Fig. 120) is attached by a strap to the winch hatch cover in front of the vehicle commander's seat.
2. Commander's rucksack 2 is secured by a strap behind the commander's seat on the plate of the front right-side wheel bay.
3. Rucksack No. 1 of the attached team is secured by a strap behind the attached team member seat close to the bay of the left-side front auxiliary wheel.

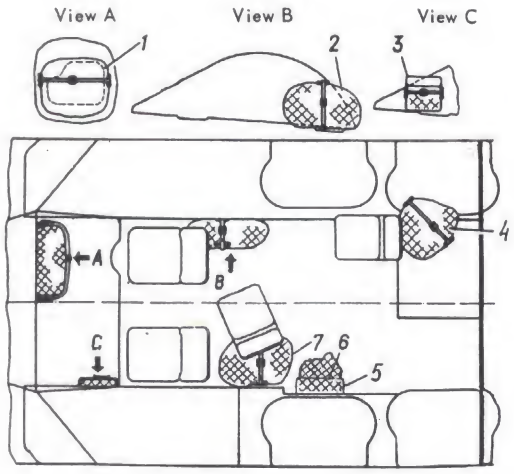


FIG. 120. ARRANGEMENT OF CREW'S STANDARD EQUIPMENT AND AUTOMOBILE DECONTAMINATION SET ДК-4Б IN VEHICLE

1 – driver's rucksack; 2 – commander's rucksack; 3 – driver's gas mask carrier; 4 – attached team rucksack No. 2; 5 – bag with set ДК-4Б; 6 – bag with gas-liquid hose; 7 – attached team rucksack No. 1

4. Rucksack No. 2 of the attached team is secured by a strap to the transfer case at the bay of the right-side rear auxiliary wheel.

5. The driver's gas mask carrier 3 is attached by a strap to the plate of the front left-side wheel bay.

COMMUNICATION FACILITIES

The vehicle is equipped with a radio transceiver for communication with the outside. For the radio set description and operating instructions refer to the papers supplied with the vehicle.

When operating the radio set remove the cover and put it in the headset bag.

NAVIGATIONAL EQUIPMENT

To increase efficiency of driving the vehicle under conditions of difficult orienting on the ground, navigational equipment is mounted on vehicle БРДМ-2. The navigational equipment is intended for automatically determining the coordinates of the object, grid azimuth of the object, grid azimuth of the point of destination, difference between coordinates of the object location and coordinates of the point of destination.

The navigational equipment set includes the following instruments, tools and papers:

1. Directional system which incorporates:
(a) gyroscopic drift indicator;
(b) control panel;
(c) current converter.
2. Travelled distance sending unit (distance transmitter).
3. Coordinate converter.
4. Course indicator.
5. Milrule.
6. Field bow compasses with a screwdriver at the end.
7. Individual SPTA set.
8. Operating instructions for navigational equipment.
9. Certificate.

The attending personnel (operator) handling the navigational equipment must learn the appropriate operating instructions.

Switch on the navigational equipment and check by the built-in tester with the engine running at the crankshaft speed ensuring the storage battery charging.

For initial orienting the vehicle is equipped with the sighting device which incorporates:

(a) an azimuth circle comprising four sectors secured to the fixed race ring of the turret mount;

(b) an azimuth vernier secured to the movable turret mount race ring;

(c) a sight of the turret mount.

The sighting device is used for determining the angle of sighting at the selected landmark. The angle value is read off when aiming the central angle mark appex of the sight reticle at the landmark by turning the turret. The azimuth circle is divided into 600 divisions spaced at 10 mils. The vernier permits reading of the angle with an accuracy of 1 mil.

In addition, the vehicle is provided with an aiming circle set for initial terrain orientation when moving under conditions of poor visibility or scarcity of landmarks, [redacted] The aiming circle set includes an aiming circle [redacted] in cover, a tripod and a lighting kit.

The devices, instruments and papers are arranged as follows:

(1) the control panel is on the front armour plate, in front of the commander;

(2) the gyroscopic drift indicator is between the bay of the front right-side wheel and bay of the auxiliary wheel;

(3) the current converter is on the hull rear plate;

(4) the coordinate converter is on the front right sloped plate of the hull superstructure (hull upper portion);

(5) the course indicator is on the driver's instrument panel; the course indicator illumination lamp is connected to the circuit of the instrument panel illumination lamps;

(6) the travelled distance sending unit (distance transmitter) is on the floor, near the front left-side wheel bay;

(7) the milrule and bow compasses are in the ponch, on the commander's seat back;

(8) the individual SPTA set of the navigational equipment is on the coordinate converter;

(9) the aiming circle in cover is on the bay of the right-side rear auxiliary wheel;

(10) the tripod in on the bay of the left-side auxiliary wheels;

(11) the lighting kit is kept in the bag on the left sloped plate of the hull superstructure;

(12) operating instructions and certificate are kept in the bag on the commander's seat back;

(13) technical description of the aiming circle is kept in the aiming circle cover;

(14) connections diagram of the navigational equipment is given in Fig. 121.

When operating the navigational equipment:

(a) never cut in the equipment with the vehicle in motion;

(b) do not start moving in less than 6 minutes or fulfilling the practical tasks in less than 13 minutes after cutting in the equipment;

(c) do not run the vehicle at a speed higher than 30 km/h if the equipment operates in the 1-meter range;

(d) never couple/uncouple the plug connectors, or eliminate troubles with the equipment energized.

The navigational equipment operating accuracy depends to a great extent on correct adjustment of the sighting device and on proper maintaining of the grid azimuth by the gyroscopic drift indicator during operation.

When operating the navigational equipment, check the following:

1. Balancing of the directional system.

2. Serviceability of the equipment (to be performed with a built-in tester).

3. Correction for the distance travelled.

4. Adjustment of the sighting device.

Sequence and time for the maintenance of the navigational equipment are specified in the operating instructions for the navigational equipment.

If the error of adjustment of the sighting device Δa_{mean} (Δy_{mean}), obtained while checking the sighting device adjustment, exceeds the value indicated in the navigational equipment operating instructions, it is necessary to introduce the correction. To this end:

1. Slacken the vernier fastening screws.

2. If Δa_{mean} (ΔY_{mean}) is less than zero, shift the vernier to the left, if it is more than zero, shift the vernier to the right.

3. Secure the vernier fastening screws.

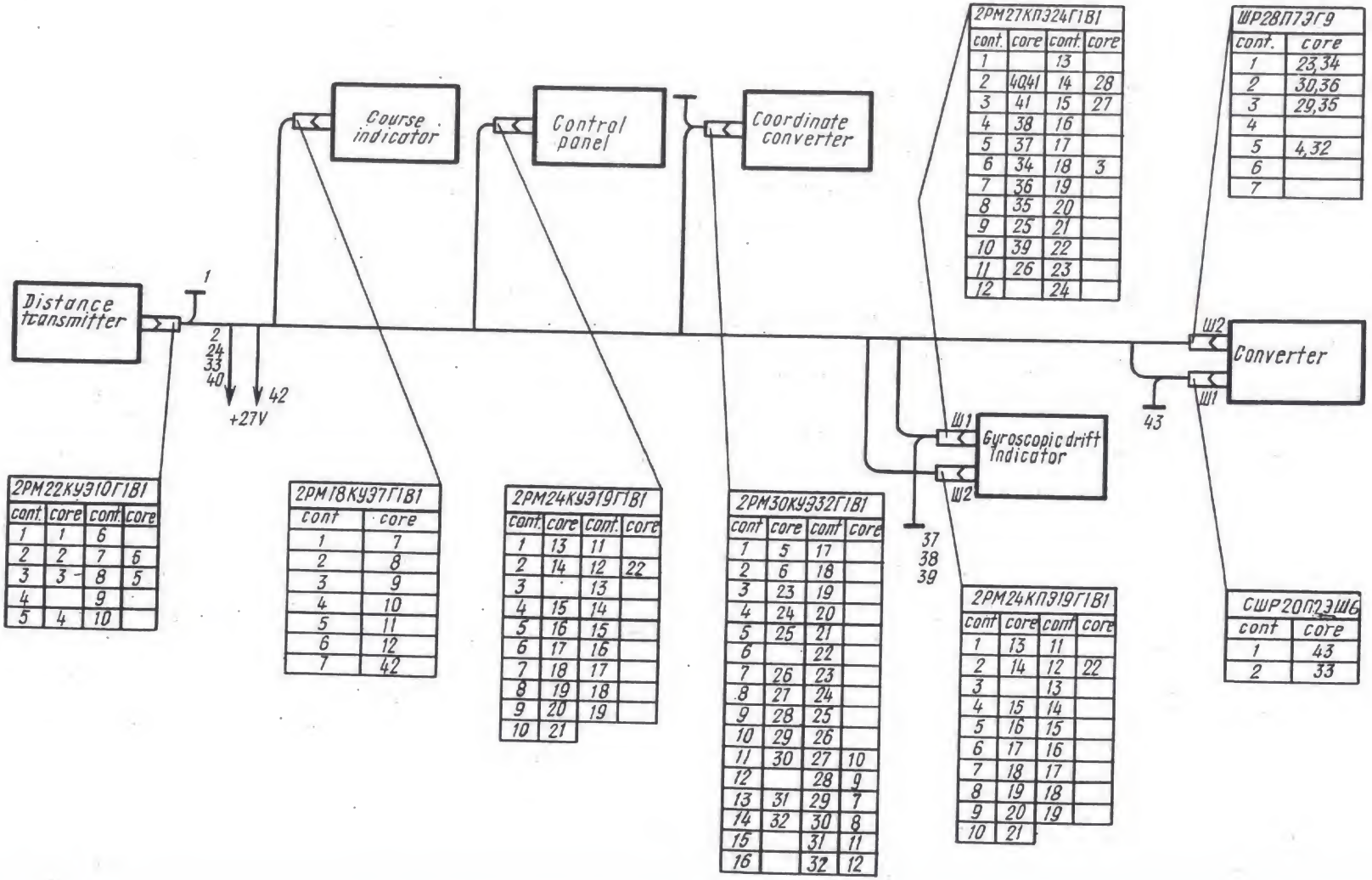


FIG. 121. CONNECTIONS DIAGRAM OF NAVIGATIONAL EQUIPMENT

Chapter 12

ARMAMENT

GENERAL

Armament on the vehicle consists of two coaxial machine guns КПВТ and ПКТ mounted in the turret.

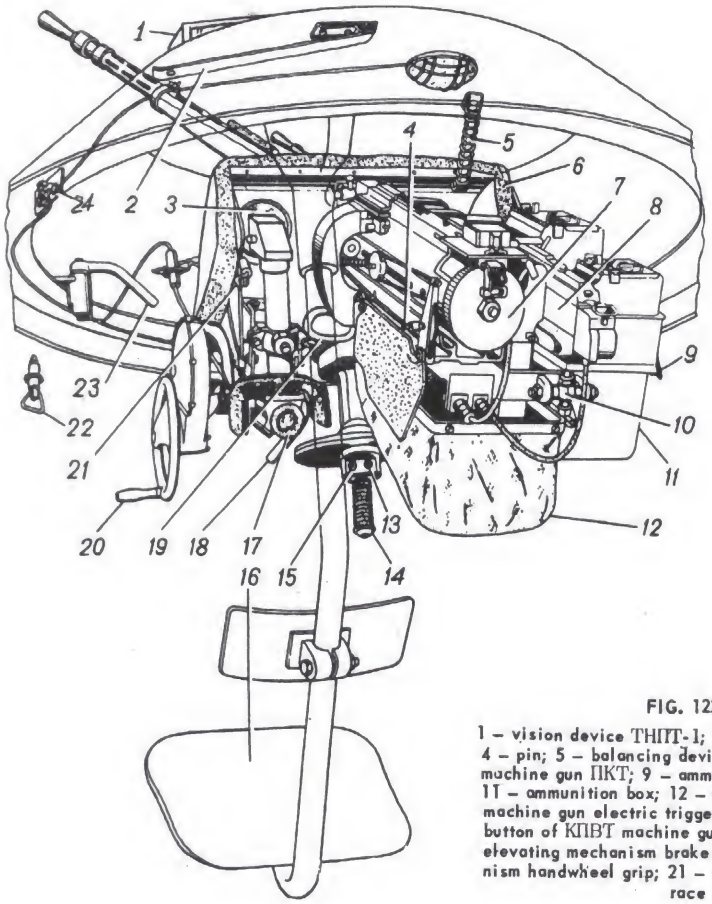


FIG. 122. TURRET MOUNT. GENERAL VIEW

1 – vision device ТНПТ-1; 2 – cradle travelling lock strip; 3 – sight protective heated glass; 4 – pin; 5 – balancing device; 6 – shield packing; 7 – machine gun КПВТ; 8 – machine gun ПКТ; 9 – ammunition box holder latch; 10 – adjusting mechanism; 11 – ammunition box; 12 – empty case-and-link deflector bag; 13 – button of ПКТ machine gun electric trigger; 14 – grip of traversing mechanism handwheel; 15 – button of КПВТ machine gun electric trigger; 16 – hammock seat; 17 – sight; 18 – elevating mechanism brake handle; 19 – retracting handle; 20 – elevating mechanism handwheel grip; 21 – wiper handle; 22 – turret travelling lock; 23 – turret race brake handle; 24 – turret electric board

The turret mount (Fig. 122) is designed to deliver aimed all-round fire on ground targets. Besides the machine guns, the turret houses the traversing and elevating mechanisms, the sight and the gunner's seat. Vision device ТНПТ-1 is mounted on the turret roof. The turret protects the gunner from rifle and machine gun fire, splinters of shells and bombs, light radiation and radioactive dust.

When driving the vehicle under noncombat conditions, the turret can be turned with its machine gun barrels facing forward or rearward and locked in the travelling position by means of lock 22 mounted on the roof inside the vehicle to the left of the turret. For releasing the turret, lock handle 4 (Fig. 123) should be pulled down and turned through 90°.

For locking the cradle in elevation, lock strip 2 (Fig. 122) installed on the turret roof should be turned down so that pin 4 enters the hole provided at the strip lower end. The strip is held in the extreme positions by a spring.

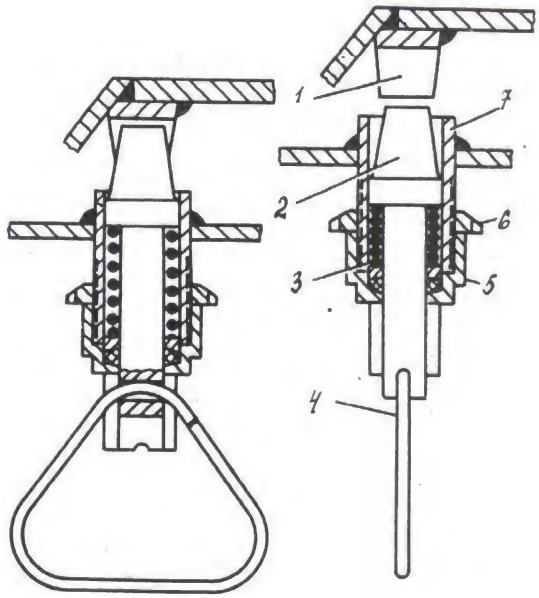


FIG. 123. TURRET TRAVELING LOCK

1 – shoe; 2 – lock; 3 – spring; 4 – handle; 5 – nut; 6 – lock nut; 7 – sleeve. To the left: turret locked in traveling position. To the right: turret unlocked

BRIEF DESCRIPTION OF TURRET MOUNT

The turret is welded of armoured plates and its shape is truncated cone. Guards that prevent bullet splashes from getting inside the turret are installed along the perimeter of the turret shield opening. The turret traverses on a ball race .

The ball race (Fig. 124) is basically a large radial thrust bearing. It consists of three rings: fixed, adjusting and movable. Fixed (lower) ring 3 of the turret race is attached to vehicle roof 20 by means of bolts 19. Adjusting ring 5 is secured to the fixed ring by bolts 18. Movable (upper) ring 12 to which the turret is bolted is installed over the fixed ring.

The turret race contains 178 balls 13 (16 mm in dia). The balls are classified by their diameter. The difference in diameter of the balls of one and the same group must not exceed 5 μ. The balls in the turret race must be of the same group only. The balls are separated by cage 11 and roll along four rings made of calibrated steel wire. The race adjusting ring must be so tightened that easy and smooth running of the movable (upper) ring without any local seizing is ensured. Play of the upper ring relative to the lower one must not exceed 0.25 mm. In the process of adjustment of the turret race, shims 4 are placed under the adjusting ring.

Tightness of the turret race is ensured by rubber sealing ring 6 fitted on the race on the outside. Between ring 6 and race rings 3 and 12, fluoroplastic film is placed. On the outside, rubber ring 6 is braced by two spring rings. The turret race is greased with lubricant ЦИАТИМ-201. On the inside, the turret race is provided with guard 14 secured to the movable ring by screws. The turret race is protected from bullets and splinters by a deflector welded to the vehicle roof.

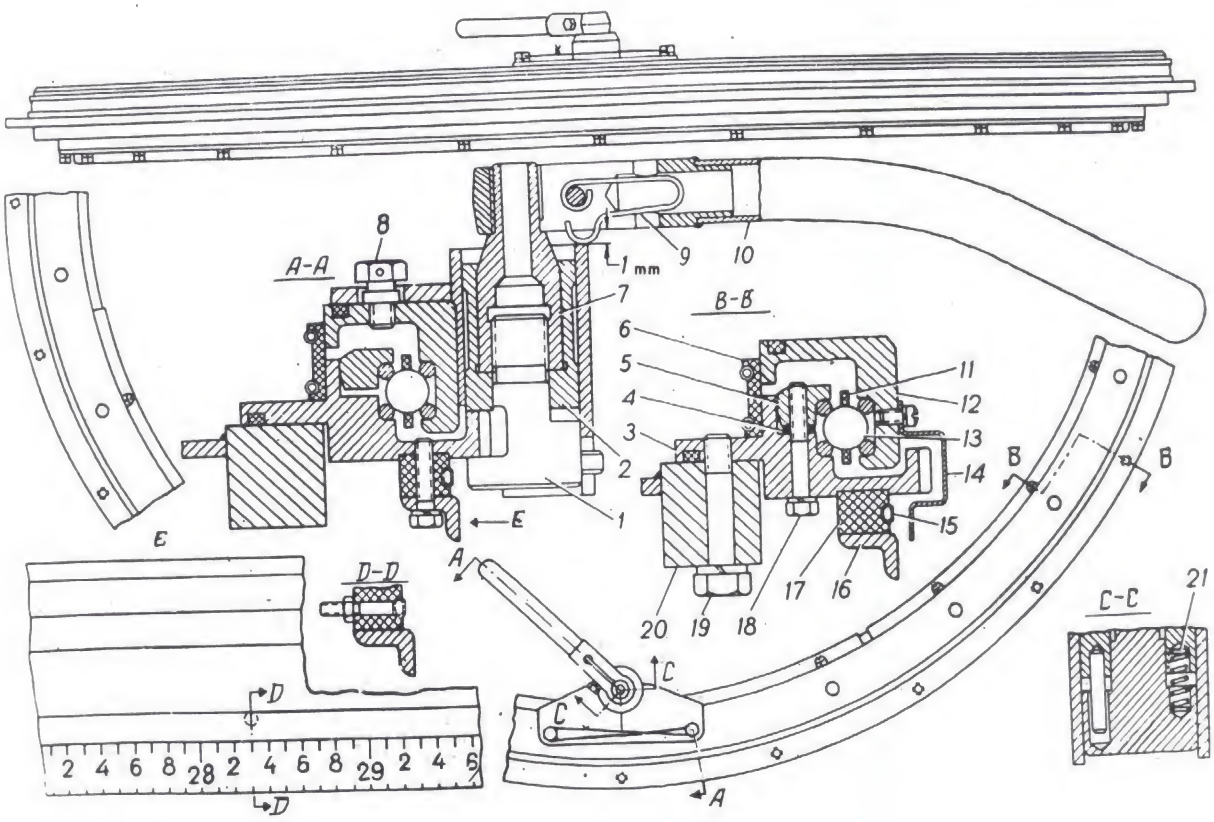


FIG. 124. TURRET BALL RACE

1 – brake shoe; 2 – bushing; 3 – fixed ring; 4 – shims; 5 – adjusting ring; 6 – sealing ring; 7 – sleeve; 8, 18 and 19 – attachment bolts; 9 – retainer spring; 10 – race brake handle; 11 – cage; 12 – movable ring; 13 – ball; 14 – guard; 15 – slip ring; 16 – azimuth circle; 17 – insulator; 20 – roof; 21 – spring; E – view of azimuth circle

Power supply to the turret from the mains is effected by the current collector through copper slip ring 15 mounted in the recess of plastic ring 17 (insulator).

The race is provided with a brake intended for locking the movable ring when fire is delivered on stationary targets as well as for zeroing the turret mount machine guns.

It is also advisable to brake the turret mount when firing on the move. To apply the brake, pull handle 10. This makes sleeve 7 screw on the extension piece of brake shoe 1 and press on bushing 2. As a result, the toothed rim of the turret race fixed ring gets clamped between bushing 2 and brake shoe 1. When handle 10 is pushed off, springs 21 press the bushing off the brake shoe and release the turret race.

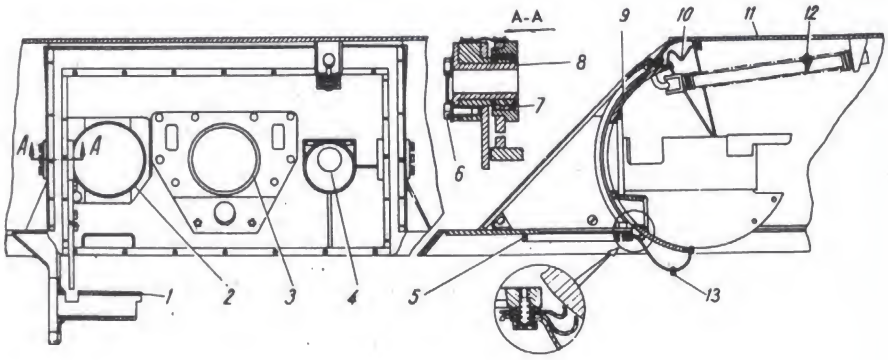


FIG. 125. TURRET WITH MECHINE GUN SHIELD

1 – sleeve of elevating mechanism brake; 2 – sight port; 3 – port for machine gun КПВТ; 4 – port for machine gun ПКТ; 5 – turret traversing mechanism attachment bracket; 6 – trunnion attachment bolt; 7 – bearing; 8 – trunnion; 9 – shield; 10 – sealing; 11 – turret; 12 – counterbalance; 13 – water drain plug

Shield 9 (Fig. 125) is installed in the opening in the front part of the turret on two trunnions 8 and spherical bearings 7. The shield is the base for attachment of the cradle, bracket and sight and offers frontal protection for the gunner and turret mount mechanisms from bullets and splinters of gun and mortar shells. The clearances between the turret and shield are packed by sealing 10 made of rubberized fabric. Water is drained through a hole in the sealing which is closed by rubber plug 13. The shield has four ports: the middle (larger) port for the КПВТ machine gun, a smaller one under the middle port for empty case ejection chute of the КПВТ machine gun, the RH port for the ПКТ machine gun, and the LH port for the sight protective glass. The shield complete with all the mechanisms mounted on it is balanced by special counterbalance 12. The front end of the counterbalance tube rests on the shield bracket while the tube rear end freely passes through a hole in the bracket welded to the turret roof.

The machine gun mount is balanced by a spring. As a result, the mount is easy to handle in elevation. To remove the counterbalance, elevate the mount machine guns so that the spring gets compressed and it becomes possible to insert the pin in the hole made at the rear end of the tube. Then depress the machine gun barrels and remove the counterbalance with the compressed spring.

The cradle (Fig. 126) is the base for attachment of the machine guns, recoil mechanisms, ammunition box holder of the ПКТ machine gun, deflector bag for empty cases and belts, empty case-and-link ejection chutes, retracting mechanism and gunner's guard. Cradle body 18 is a rigid formed frame. At the front, the cradle body is attached to the shield by eight studs welded in the bracket base, and by two bolts.

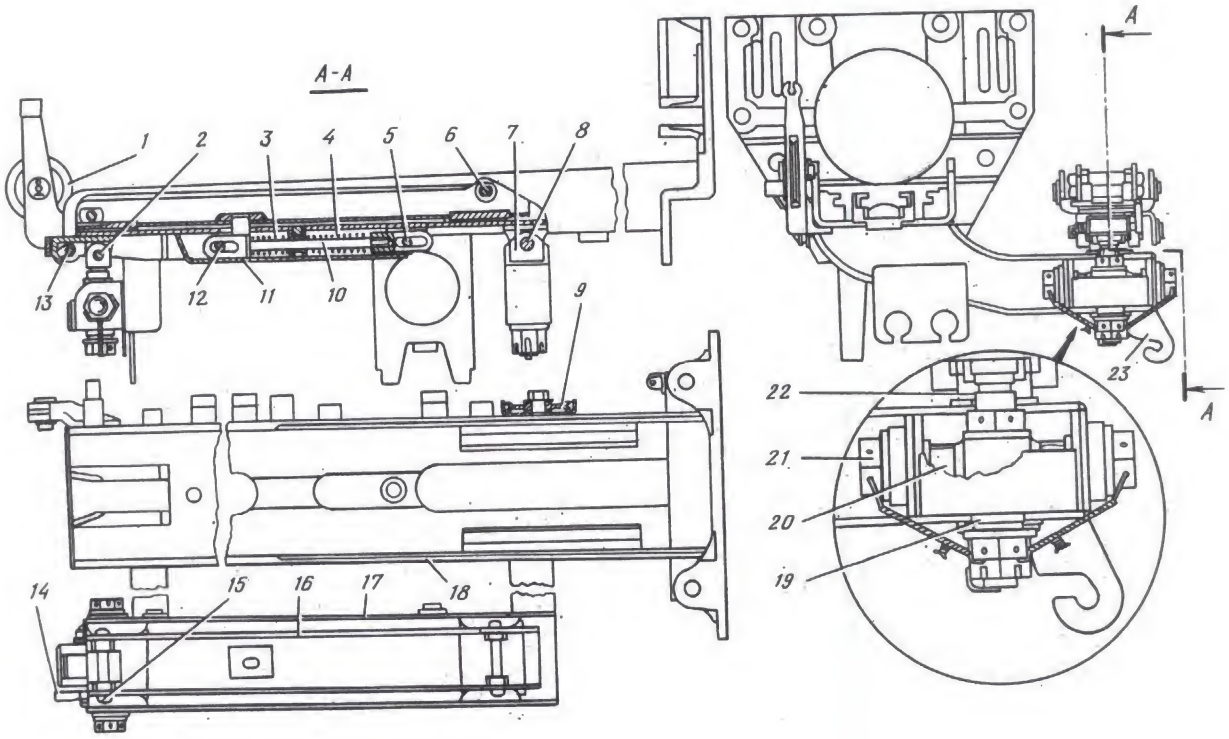


FIG. 126. CRADLE-AND-CARRIAGE ASSEMBLY

1 and 9 – rollers; 6 and 15 – machine gun ПКТ attachment axles; 3 and 4 – springs; 5 and 12 – shock absorber attachment axles; 7 – pivot; 2 and 8 – carriage base attachment axles; 10 – rod; 11 – carriage casing; 13 – latch; 14 – latch lever; 16 – carriage; 17 – carriage base; 18 – cradle body; 19 – post bushings (upper and lower); 20 – horizontal screw; 21 – threaded bushings (R.H and LH); 22 – post; 23 – hook for fastening empty case-and-link deflector bag

The front portion of the cradle has grooves for receiving the guide lugs of the base of the КПВТ machine gun recoil mechanism collar while the rear portion of the cradle has a guide for the slide of the machine gun rear attachment. Welded on the right side of the cradle are two brackets securing the base of the ПКТ machine gun carriage.

Carriage 16 is the bed for the ПКТ machine gun. Carriage base 17 is secured on two welded brackets of the cradle: the front part of the carriage base is secured by means of pivot 7 and axle 8, and the rear part, by means of an adjusting device which permits shifting the rear end of the carriage base both horizontally by using screw 20 and two threaded bushings 21, and vertically by making use of post 22 and two threaded bushings 19. The threaded bushings of the adjusting device are cottered with wire. Only when zeroing the machine guns must be the threaded bushings uncottered and the position of the carriage adjusted. The adjusting device is hinged to the carriage base by means of axle 2.

When firing the ПКТ machine gun, lengthwise forces are taken by two springs: larger spring 4 takes up the machine gun recoil and smaller spring 3 takes up the counterrecoil. Latch 13 mounted on the carriage base casing 11 locks the carriage.

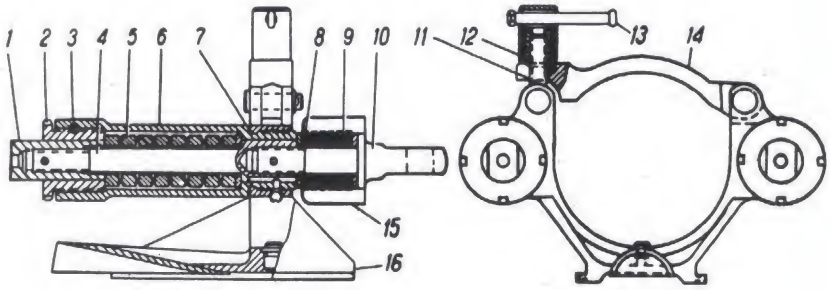


FIG. 127. RECOIL MECHANISM
1 – adjusting bushing; 2 – nut; 3 – pin; 4 – rod; 5 – spring; 6 – recoil mechanism housing; 7 – adjusting washers; 8 – rubber ring; 9 – washer; 10 – eye; 11 – lock shackle; 12 – spring; 13 – lock handle; 14 – clip; 15 – casing; 16 – collar base

The recoil mechanism (Fig. 127) is designed for damping the loads exerted on the turret mount when firing the КПВТ machine gun. For this purpose, the machine gun is secured on recoil mechanism collar base 16 by means of clip 14. In the course of firing the machine gun recoil is taken up by housing 6 and spring 5 and is transmitted to adjusting bushing 1 and rod 4. The latter is screw-jointed with eye 10 which is attached to the shield by a lock. Counter-recoil is absorbed by rubber buffer rings 8; between the rings washers 9 are placed. The buffer rings are enclosed with casing 15 that protects them from lubricant. For removing the receiver of the КПВТ machine gun jointly with the recoil mechanism, locks 2 (Fig. 128) that connect the shield with the eye of the recoil mechanism should be disengaged by means of two levers 4.

The retracting mechanism is used for cocking the КПВТ machine gun. To cock the machine gun, apply an energetic and ceaseless effort to pull down handle 19 (see Fig. 122) until the machine gun bolt is engaged by the sear. From the handle, the effort is transmitted through the cable to the retracting slide whose lug engages the bolt group and moves jointly with the latter towards the extreme rear position until the sear engages the bolt camming lugs. As a result, the machine gun mainspring gets compressed and the retracting spring extended.

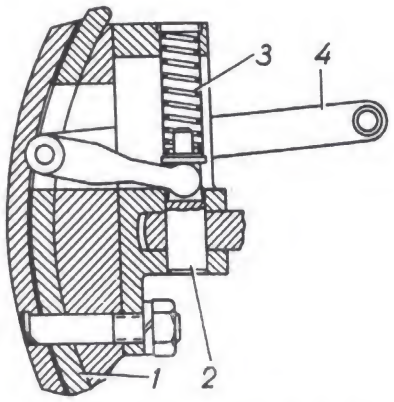


FIG. 128. RECOIL MECHANISM ATTACHMENT

1 – shield; 2 – lock; 3 – spring; 4 – lever

Traversing mechanism handwheel 1 mounts grip 10 provided with push buttons of machine gun electric triggers: LH push button 12 for the КПВТ machine gun and RH push button 11 for the ПКТ machine gun. Current collector 8 with plug connector 7 is attached to the casing of handwheel 1.

The traversing mechanism ensures smooth all-round traverse of the turret mount without seizing when an effort of not over 5 kgf is applied to handwheel grip 10.

The turret traversing mechanism does not require any adjustment by the using arms personnel.

The elevating mechanism (Fig. 130) is used for laying the turret mount machine guns in elevation. The elevating mechanism reduction unit consists of three gears. Driving gear 3 is in mesh with toothed arc 8 attached to shield LH check 1. Reduction unit case 4 is bolted to turret LH check 2. Handwheel 5 is fitted with grip 6. The gears and bearings of the elevating mechanism are lubricated with lubricant ЦИАТИМ-201. The elevating mechanism needs no adjustment during operation of the vehicle.

The elevating mechanism brake serves for braking of the turret mount tipping part at any elevation or depres-

After the cocking, quickly release the cable handle (don't let it off). When released, the handle quickly returns to the forward position due to the spring and does not impede operation of the bolt in the course of firing.

The turret traversing mechanism (Fig. 129) is used for azimuth laying of the turret mount machine guns. The traversing mechanism reduction unit consists of two gears: driving gear 3 and driven gear 5. The driven gear is constantly meshed with the toothed rim of race fixed ring 4. The gears are lubricated with lubricant ЦИАТИМ-201.

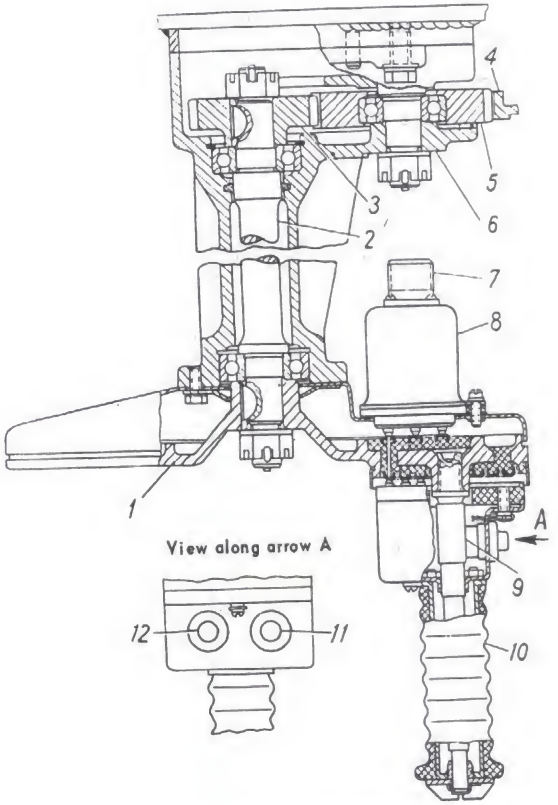


FIG. 129. TURRET TRAVERSING MECHANISM

1 – handwheel; 2 – handwheel shaft; 3 – driving gear; 4 – turret race fixed ring; 5 – driven gear; 6 – case; 7 – plug connector; 8 – current collector; 9 – grip axle; 10 – grip; 11 – push button of machine gun ПКТ electric trigger; 12 – push button of machine gun КПВТ electric trigger

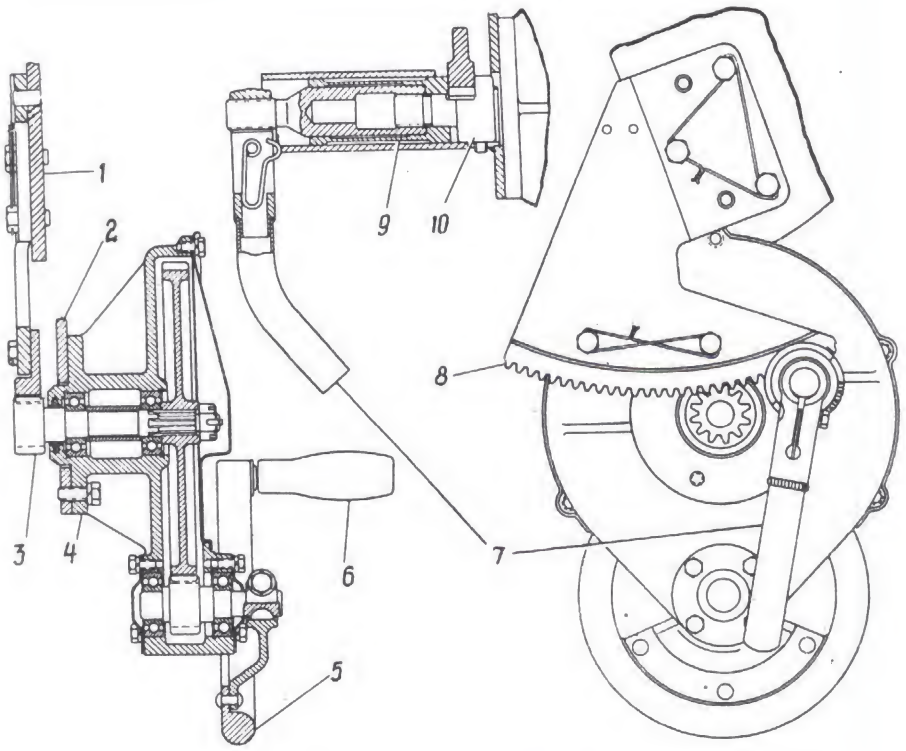


FIG. 130. ELEVATING MECHANISM

1 – shield L.H cheek; 2 – turret L.H cheek; 3 – elevating mechanism driving gear; 4 – reduction unit case; 5 – handwheel; 6 – handwheel grip; 7 – brake handle; 8 – arc; 9 – brake sleeve; 10 – brake shoe

sion angles. Pulling of handle 7 results in clamping of elevating arc 8 between brake sleeve 9 and brake shoe 10; thus the turret mount tipping part is braking. When the handle is pushed to its forward position the turret mount becomes released.

The sight (Fig. 131) serves for observing the terrain and laying the machine guns on a target. It has a 2.6X magnification and a 23° field of view.

The sight ball journal is secured in bracket 6 bolted to the shield. The sight is held in the bracket by means of strap 9 and two studs with nuts 10.

To create normal operating conditions for the sight optical system when air humidity is high, use is made of desiccator 3. The latter is actually a capsule containing silica gel that absorbs excess of moisture. The desiccator is arranged inside the sight. As silica gel becomes saturated with moisture, it changes its colour from dark blue to lighter colours. Pink silica gel indicates that the desiccant capsule should be replaced since silica gel has lost its absorbtivity.

After using all the spare capsules available in the sight ЗРТА set restore the silica gel absorbtivity by heating it following the procedure described in the sight technical description.

Silica gel may be restored many times as its quality is not affected by the process.

The sight is protected against damage by protective glass 2. When dirty, it is manually cleaned with the windshield wiper.

Sight protective glass 2 is electrically heated. On turning the RH switch on the turret electric board on, a pilot lamp flashes thus indicating that heating of the sight protective glass commences.[x]

x) Heating of the ТНПТ-1 vision device is simultaneously switched on (refer to Chapter 10 "Vision Devices").

The heater operation time at a temperature below +5°C is not limited. At an air temperature of up to +20°C the heater may be used for the period of not more than 10 minutes.

At a temperature above +20°C the heater may never be used as that leads to glass overheating and, as a result, to its damage. The symptoms of overheating are yellowish brown spots and stains on the glass surface.

The sight is used as a direct fire sight for firing the КПВТ machine gun, at a distance of up to 2000 m and the ПКТ machine gun at a distance of up to 1500 m, against both stationary and moving targets. The field of view of the sight includes a reticle (Fig. 132) having the elevation scales for the ПКТ and КПВТ machine guns and the deflection scale. Used as the zero mark in both the scales is the angle apex. The LH scale of the reticle is used for laying the КПВТ machine gun and the RH scale, for laying the ПКТ machine gun. Every second horizontal line on the sight reticle is marked with a figure. The values of the figures and reticle lines are given in the table of elevation below.

The upper part of the reticle which includes the deflection scale (vertical lines) is used for introduction of deflection for movement of a target. The range of the deflection scale whose reference line is aligned with the centre of the field of view is ±0 to 32 mils. A division of the deflection scale corresponds to 2 mils.

The sight scale is selected depending on the type of the machine gun which will be used for conducting the firing, and the scale division is selected depending on the range of fire.

Determine the distance, then rotate the traversing mechanism handwheel and the elevating mechanism handwheel and align the respective line of the sight scale with the target. Thus, the machine gun aiming at the target will be accomplished.

Table of Elevation

КПВТ machine gun (LH scale of reticle)		ПКТ machine gun (RH scale of reticle)	
Range, m	Range designation	Range, m	Range designation
-	-	200	Small line
400	4	400	4
600	Small line, lower next	600	Small line, lower next
800	8	800	8
1000	Small line, lower next	1000	Small line, lower next
1200	12	1200	12
1400	Small line, lower next	1400	Small line, lower next
1600	16	1500	15
1800	Small line, lower next	-	-
2000	20	-	-

Adjustment of the sight is carried out whenever it is necessary, when zeroing the turret mount machine guns, and when checking the mount by means of the testing target.

To adjust the sight, loosen locking screw 7 and pressing screw 8 and screw off nuts 10 so that the sight can be turned in the bracket by the effort of hands. This

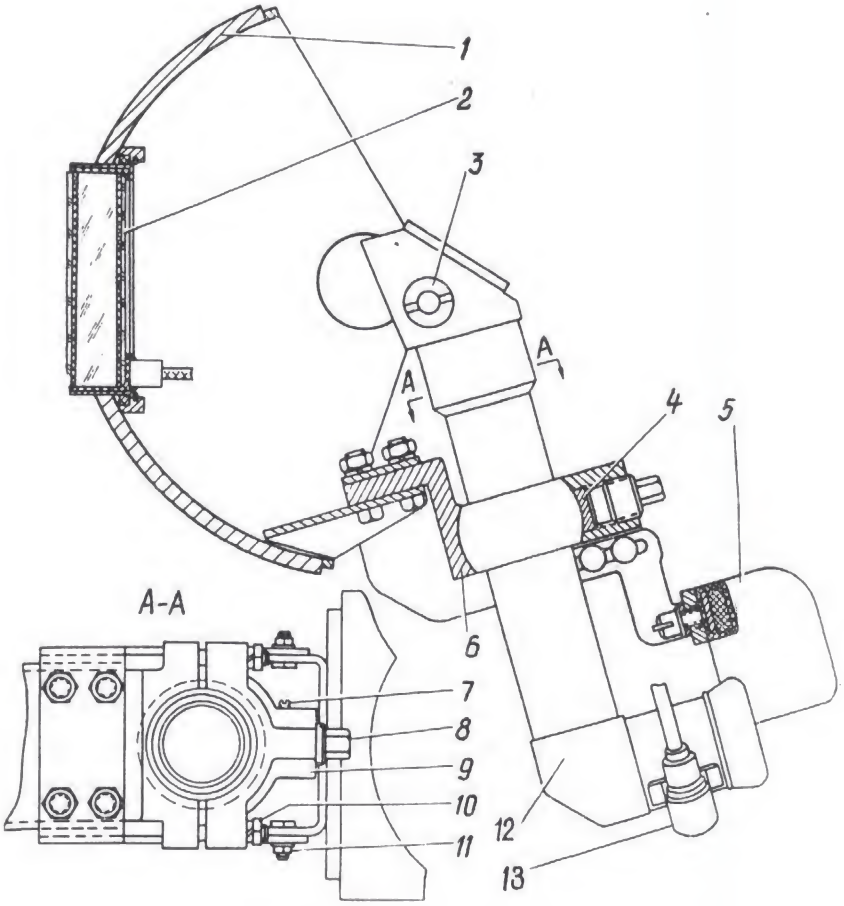


FIG. 131. SIGHT MOUNTING

1 – turret shield; 2 – protective heated glass; 3 – sight desiccator; 4 – backing; 5 – headrest; 6 – bracket; 7 – locking screw; 8 – pressing screw; 9 – bracket strap; 10 – cover plate fastening nut; 11 – headrest nut; 12 – sight; 13 – sight brightening lamp holder

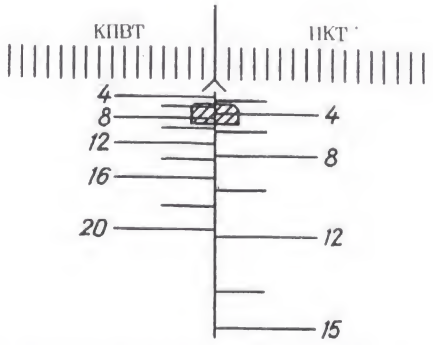


FIG. 132. SIGHT RETICLE AND AIMING MACHINE GUNS AT TARGET

done, lay the sight on the testing target so that the angle apex on the sight reticle is aligned with the centre of mark П on the testing target. Lock the sight in the above position by means of pressing screw 8. Then tighten nuts 10 that secure the sight strap, one by one, while gradually loosening pressing screw 8. After adjustment, check to see that the sight position is not disturbed and fasten pressing screw 8 with locking screw 7 (Fig. 131). Never touch the sight head with hands in the course of installation, adjustment or boresighting.

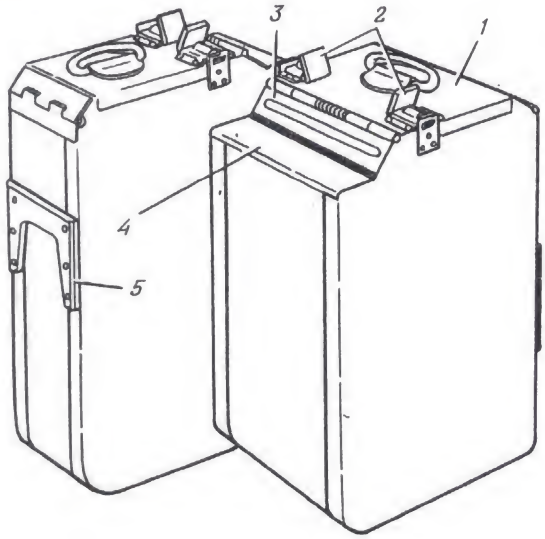


FIG. 133. AMMUNITION BOXES
1 – cover; 2 – retainers; 3 – cover flap; 4 – tray; 5 – thrust lining.
Left: machine gun ПКТ ammunition box.
Right: machine gun КПВТ ammunition box

The ammunition boxes (Fig. 133) serve for stowing the belts loaded with cartridges. The vehicle is furnished with 10 large ammunition boxes, containing 50 rounds for the КПВТ machine gun each, and with 8 small ammunition boxes, containing 250 rounds for the ПКТ machine gun each. Atop, the box is provided with tray 4 having a flat for the first round. Mounted on ammunition box cover 1 are two retainers 2 used for locking the cover. Cover flap 3 prevents the loaded ammunition belt from falling out of the box.

Before placing the ammunition belt into the ammunition box, depress the slides of retainers 2 and open cover 1. When filling the ammunition box, put the ammunition belt in lines.

After the ammunition box is installed in the box holder, open cover 1, take the belt out of the ammunition box and arrange its first cartridge on the flat of tray 4; then close cover 1. The cartridge is held in this position by cover flap 3.

Never throw the ammunition boxes. Never tread or sit on them. Dents on the ammunition boxes may cause stoppage in firing. If the dents cannot be mended, replace the ammunition box.

The ammunition box holders (Fig. 134) are used for mounting the ammunition boxes. When the box holder latch is depressed, it releases the ammunition box and the latter can be removed downward. The larger box holder (for the КПВТ machine gun) is secured to the reinforcing piece of the turret shield tube, and the smaller one (for the ПКТ machine gun) is attached to the carriage base.

The empty case-and-link ejection chutes (Fig. 135) are used for removal of empty cases and ammunition belt links in the course of firing. Secured in the feed block of the КПВТ machine gun is a tray that moves together with the machine gun. The clearance between the tray and link chute should be 0.3 to 3.2 mm.

Empty cases of the КПВТ machine gun are ejected from the turret via empty case ejection chute 3 whose rear end is attached to the cradle. The front end of the empty case ejection chute is provided with end piece 4 fitted with gate 5 and a spring. In the course of firing the empty cases open the gate and fall outside. The last two or three empty cases of the machine gun burst may remain in empty case ejection chute 3 and one of the empty cases may get trapped in gate 5. When firing is over, remove these empty cases.

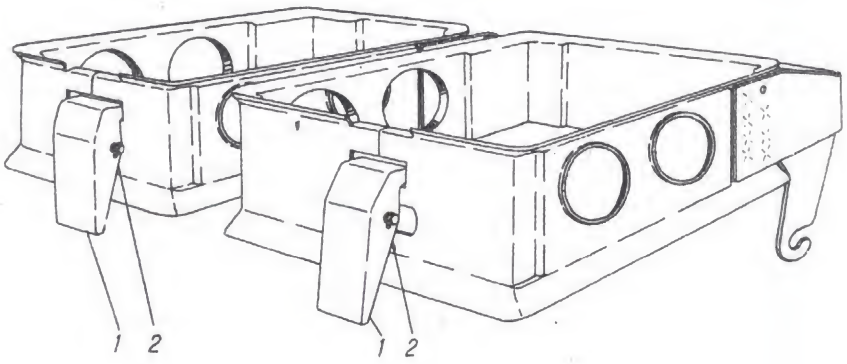


FIG. 134. AMMUNITION BOX HOLDERS
1 – latch; 2 – spring
Left: machine gun ПКТ ammunition box holder
Right: machine gun КПВТ ammunition box holder

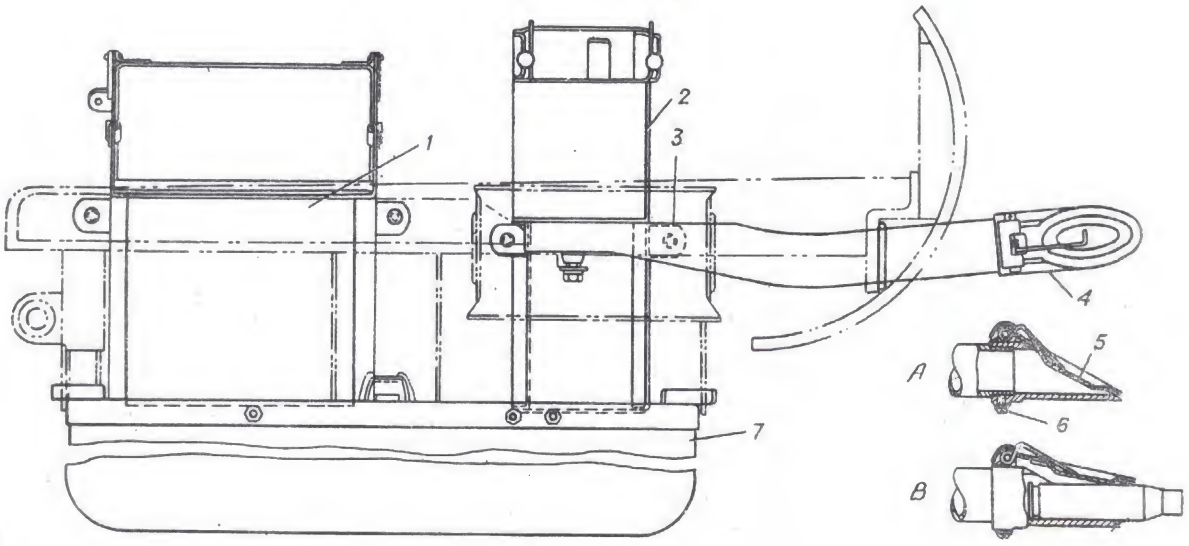


FIG. 135. EMPTY CASE-AND-LINK EJECTION CHUTES

1 – empty case-and-link ejection chute of machine gun ПКТ; 2 – link ejection chute of machine gun КПВТ; 3 – empty case ejection chute of machine gun КПВТ; 4 – end piece of machine gun КПВТ empty case ejection chute; 5 – gate; 6 – screw; 7 – deflector bag; A – gate closed; B – empty case trapped by gate

The empty case-and-link ejection chute of the ПКТ machine gun is used for removal of the ПКТ empty cases and ammunition belts.

When dismounting the КПВТ machine gun from the cradle, turn the cover of the ПКТ empty case-and-link ejection chute to the inside of its casing.

Deflector bag 7 is used for collection of empty cases and ammunition belt links of the machine guns. It is attached to the cradle by means of two axles and a latch.

When replacing ammunition boxes in the course of firing, take piled empty cases and ammunition belt links out of the deflector bag and put them into an empty ammunition box to prevent overfilling of the deflector bag.

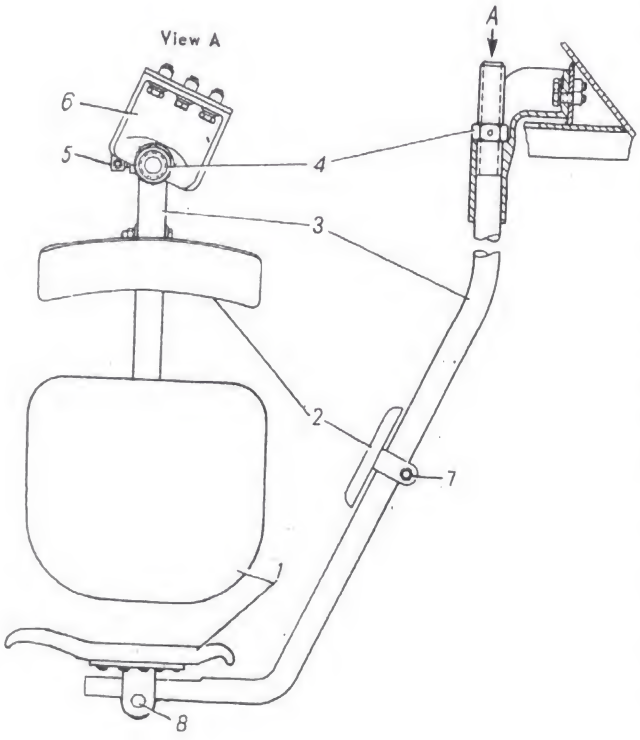


FIG. 136. HAMMOCK SEAT

1 – seat; 2 – back rest; 3 – rod; 4 – nut; 5 – lock; 6 – bracket; 7 and 8 – clamping bolts

The hammock seat (Fig. 136) traverses jointly with the turret and can be adjusted in height by shifting rod 3 in bracket 6 by means of nut 4. Seat 1 and back rest 2 are also adjustable (the seat in the horizontal plane, and the back rest in height). To carry the adjustment, it is sufficient to release clamping bolts 7 and 8. Lock 5 secured in bracket 6 prevents the seat from turning.

Electrical equipment of the turret mount is a single-wire system (see Fig. 77). The power consumers (machine gun electric triggers, sight brightening lamp, turret dome light, turret electric board light, pilot lamp, ТНПТ-1 vision device and sight electrically heated protective glass are supplied by the vehicle mains. From the vehicle mains current is fed to slip ring 15 (see Fig. 124), then to the current collector and the turret electric board, and finally to the turret mount power consumers. The turret electric board has four switches: the LH switch for the turret dome light, the second switch for the sight brightening and the board illumination, the third switch for the machine gun electric triggers, the fourth switch for heater of the sight protective glass and ТНПТ-1 vision device.

The current collector (Fig. 137) is secured on the lower flange of the turret. Its metal housing 3 contains plastic bushing 2 fastened by plastic nut 5. The bushing houses brass rod 6 having silver tip 1. Spring 4 ensures proper contact of tip 1 of rod 6 to the race slip ring. In case of insufficient contact, shift the current collector closer to the slip ring. For this purpose, screw off two bolts in the current collector bracket, shift the current collector to the required distance and tighten up the bolts.

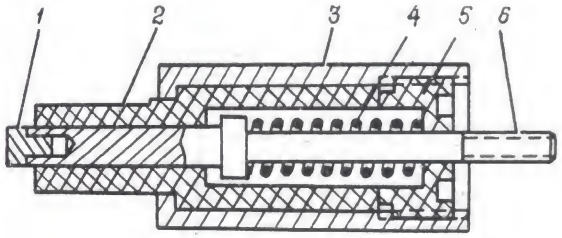


FIG. 137. CURRENT COLLECTOR

1 – tip; 2 – bushing; 3 – housing; 4 – spring; 5 – nut; 6 – rod

OPERATION OF TURRET MOUNT

Traveling Position

When in the traveling position, the machine guns must be unloaded, the turret and the ripping part locked, the machine gun bolts disengaged from the sears, ammunition boxes placed in the racks, and the electric trigger switch, sight brightening lamp switch, turret dome light switch, sight protective glass and ТНПТ-1 device heater switch set to the OFF position; the turret, breech piece of the turret mount and the sight must be covered with canvas.

Changing Turret Mount from Traveling Position to Combat Position and Preparation of Machine Guns for Firing

To change the turret mount from the traveling position to combat position, proceed as follows:

1. Remove canvas covers from the turret, breech piece and sight, and put them inside the vehicle.

2. Unfasten the turret mount traveling locks. For this purpose, throw upward the strip of the machine gun mount elevating lock, pull the turret traversing lock handle and turn it through 90°.

3. Check the machine guns and empty case-and-link ejection chutes for reliable attachment and that the clearance between the КПВТ machine gun barrel casing and the bracket collar is not less than 0.1 mm. The clearance is attained by adjustment of the collar.

4. Check to see that the machine guns are prepared for firing according to the brief instructions on use of machine guns КПВТ and ПКТ.

Note. The turret mount machine guns must be timely checked with the boresighting target. To make the boresighting target, follow the pattern set in the Service Log. If necessary, zero the machine gun mount (see Section "Zeroing Turret Mount Machine Guns" which is to follow).

5. Check ammunition belts for proper filling. If necessary, pass the КПВТ machine gun ammunition belt through a cartridge aligner and align the ПКТ cartridges manually.

6. Remove one КПВТ ammunition box and one ПКТ ammunition box from the racks. Place the ammunition boxes in the box holders and arrange the first cartridges of both the belts on the trays of the ammunition boxes.

7. The gunner must adjust the hammock seat in height, take a seat, turn on the machine gun electric trigger switch and, if required, the sight brightening lamp and protective glass heater switches, elevate the machine gun barrels to the maximum elevation angle and brake the elevating mechanism.

8. Check the circuit of electric triggers and the latter for functioning. To this end, traverse the turret through 360° while periodically, every 10-15°, depressing one of the electric trigger push buttons. If the circuit and electric triggers are serviceable, a click must be heard.

9. Load the КПВТ machine gun. For this purpose, do the following:

(a) bring the end of the ammunition belt into the feed block so that the first cartridge is gripped by the feeding and holding pawls;

(b) cock the bolt by swiftly pulling the retracting handle until the bolt is engaged by the sear and smoothly return (do not let go!) the handle to the initial position;

(c) depress the LH push button of the electric trigger. As a result, the bolt will be actuated by the mainspring and slide to the extreme forward position, and the extractor will grip the next cartridge in the feedway;

(d) use the retracting handle again to shift the bolt to the extreme rearward position, i.e. to cock the bolt;

(e) smoothly return the handle to the initial position.

The KIBT machine gun is now ready to fire.

10. Load the ПКТ machine gun. For this purpose, do the following:

(a) open the cover of the ПКТ machine gun receiver;

(b) place the first cartridge of the belt in the extractor;

(c) close the receiver cover;

(d) pull the retracting handle from the forward to the rearward position until the bolt is engaged by the sear, i.e. until the bolt is cocked, then shift the handle forward.

The ПКТ machine gun is now ready to fire.

Firing and Unloading

Conduct of fire

To conduct fire, it is necessary to lay the turret mount at the target (see Subsection "Sight"), depress one of electric trigger push buttons and fire machine guns KIBT or ПКТ depending on the type of the target. Firing is conducted automatically until the electric trigger push buttons are depressed.

To extend the service life of the machine gun barrels, it is advisable to fire in short bursts, except for special cases necessitated by the combat situation, kind and size of the target, and fire range.

Fire is delivered on order or at will depending upon the mission and situation.

Real fire is used against:

(a) large targets including armoured cars, trucks, weapon emplacements, and the like, by firing the KIBT machine gun;

(b) small targets including enemy soldiers, sniper's nests, and the like, by firing the ПКТ machine gun. If these targets are at a great distance, fire the KIBT machine gun on them;

(c) enemy concentration or conveys of trucks and mechanized infantry, etc. In this case, firing both the machine guns simultaneously is permissible.

Practice fire or zeroing of the turret mount machine guns is conducted in a special practice range or in a specially assigned area guarded by the range area sentry line.

After firing machine gun KIBT, an empty case may be trapped in the gate of the empty case ejection chute tube. This may result in partial depressurization of the habitable compartments. Therefore, push the empty case out with the screwdriver or other tool through the slot made in the lower portion of the empty case ejection chute. In case of a double misfire when firing the KIBT machine gun, the bullet of the second cartridge can pin the primer of the first one. To avoid this, push the defective cartridge out of the empty case ejection chute tube after each misfire.

When firing is over, proceed as follows:

(a) turn off the electric trigger switches, sight brightening lamp switch and protective glass heater switch on the turret control board;

(b) remove empty cases from ejection chute of machine gun KIBT;

(c) elevate the barrels of the machine gun to the maximum angle;

(d) unload the machine guns

(e) made empty the deflector bag.

Unloading of Machine Guns

1. If, after fire is ceased, the belt contains non-fired cartridges, the bolt is retained in the rearward position (seared), a live cartridge is held in the recess of the bolthead and the next cartridge is in the feedway.

To unload the KIBT machine gun in this case, proceed as follows:

(a) open the receiver cover;

(b) retain the bolt by holding the retracting handle, disengage the bolt from the sear and let it move forward until the rigid stop of the bolt is against the recess in the receiver wall and the cartridge held in the bolthead recess is against the opening in the receiver bottom; then press the top part of the feeder by hand to drive the cartridge to the tube of the empty case ejection chute;

(c) sear the bolt; for this purpose, retract it by means of the retracting mechanism;

(d) remove the next cartridge from the belt through the feedway by making use of an empty case or screwdriver;

(e) depress the feed block holding pawls with the left hand and remove the ammunition belt from the feed block with the right hand;

(f) close the receiver cover;

(g) disengage the bolt from the sear.

2. If the machine gun fired until the ammunition supply become exhausted, proceed as follows:

(a) open the receiver cover and make sure there is no cartridge or non-ejected cartridge case in the bolthead recess;

(b) close the receiver cover;

(c) for the checking purpose, cock the bolt and release it from the sear.

To unload the ПКТ machine gun, proceed as follows:

(a) open the receiver cover;

(b) remove the belt;

(c) take the cartridge out of the feed opening;

(d) close the receiver cover;

(e) for checking purpose, release the moving parts from the sear.

After firing, wipe and lubricate the machine gun bores with gun grease.

Zeroing of Turret Mount Machine Guns

The turret mount machine guns must be zeroed in case of replacement of both or one of the machine guns, the sight, heated protective glass and boresighting gauge, in case of drawing up the testing target or in case of apparent deterioration of close pattern and accuracy of fire, as well as after replacement of the turret mount or repair of its mechanisms.

Prior to zeroing, thoroughly inspect the machine guns and eliminate the disclosed troubles. The machine gun mount should be zeroed under favourable weather and lighting conditions and by using ammunition of one and the same lot for each machine gun.

To reduce time losses and expenditure of ammunition, check adjustment of the sight optical axis in relation to the axes of the machine gun bores prior to zeroing. For the checking, proceed as follows:

1. Position the vehicle on a hard level ground so that its front faces the direction of firing. The inflation pressure must be uniform for all the tyres and equal to 2.8 kgf/cm^2. Stop the engine. Shift in the first speed gear and apply the hand brake.

2. Remove the canvas covers from the turret mount.

3. Adjust the machine guns so that they face straight forward.

4. Install a board at a distance of 100 m from the КПВТ machine gun flash hider. Set plumb the boresighting target (Fig. 138) on the board with its centre at the level of the machine gun barrel horizontal axis. The boresighting target should be properly illuminated, and the source of light must not impede aiming of the machine guns and sight on the crosses and aiming mark of the target.

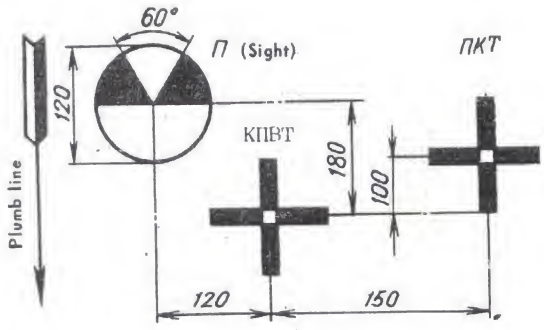


FIG. 138. BORESIGHTING TARGET

5. Insert a 14.5-mm boresighting gauge ТХП into the КПВТ machine gun bore until it thrusts against the shoulder and see that the vertical hair is parallel with the plumb line on the target. The boresighting gauge thumb piece should be set upwards.

6. Use the elevating and traversing mechanisms to aim the boresighting gauge crosshair on the centre of the target cross designated "КПВТ". In this position, brake the traversing and tipping parts of the turret mount. When using the boresighting gauge, bear in mind that the image viewed in the gauge is inverted with respect to the real image.

7. Remove the flash hider (left-hand thread) from the ПКТ machine gun, insert a 7.62-mm boresighting gauge into the bore until it thrusts against the shoulder and

see that the vertical hair is parallel to the plumb line on the target. The boresighting gauge thumb piece should be set upwards. The boresighting gauge crosshair must match the target cross designated "ПКТ".

8. If the crosshair fails to coincide with the target cross, change the position of the ПКТ machine gun: For this purpose, uncotter the bushings of the carriage adjusting mechanism preliminarily. Then use the carriage adjusting mechanism to aim the ПКТ machine gun so that the boresighting gauge crosshair is at the centre of the target cross designated "ПКТ". Check aiming of the machine gun with the boresighting gauge by laying the machine gun three times.

9. After the machine guns barrels are aimed on the corresponding crosses of the target, check the position of the sight. The point of intersection of the sight reticle vertical and horizontal lines (the apex of the angle) must coincide with the centre of aiming mark "П" of the target. In case of failure, adjust the sight in compliance with the instructions given on page 200.

10. Remove the boresighting gauges from the bores of the КПВТ and ПКТ machine guns and place them in cases. Fasten the cases at their specified places in the vehicle.

11. Screw the flash hider on the ПКТ machine gun barrel.

To check the turret mount machine guns for close pattern and firing accuracy, proceed as follows:

(a) position the vehicle in the same manner as when checking the position of the machine gun and sight axes;

(b) install the boresighting target as described above;

(c) place the ammunition boxes into the box holders;

(d) place the first cartridge of each belt beyond the holding pawls of the machine gun feed blocks and cock the machine guns;

(e) turn on the electric trigger switch and, if required, the protective glass heater switch located on the turret mount board;

(f) press the electric trigger push buttons on the traversing mechanism handwheel grip and fire five setting shots of each machine gun in the КПВТ and ПКТ fire sector;

(g) turn off the electric trigger switch on the turret mount board and unload the machine guns;

(h) operate the traversing and elevating mechanisms to align the machine gun sight angle on the target aiming point designated "П" and brake the traversing and tipping parts of the turret mount;

(i) the machine gun bores must be aligned on the corresponding crosses on the target. Use the boresighting gauges for the checking. If the alignment of crosshairs is disturbed, correct aiming or adjust the position of the ПКТ machine gun and the sight;

(j) remove the boresighting gauges from the machine gun bores and stow them in assigned places;

(k) replace the boresighting target with the zeroing target (Fig. 139);

(l) load the machine guns and turn on the electric trigger switch on the turret mount board;

(m) operate the elevating and traversing mechanisms to lay the turret mount on the target aiming point (align the apex of the sight reticle angle on the aiming point) and reliably brake the mount;

(n) depress the LH electric trigger push button and fire a burst of 10 shots of the КПВТ machine gun and a burst of 10 shots of the ПКТ machine gun. Fire each machine gun separately with the sight set at 0;

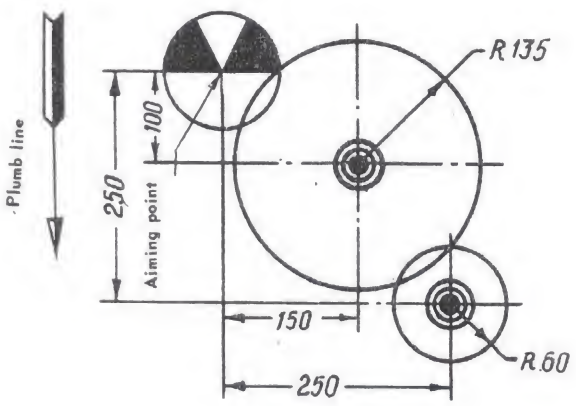


FIG. 139. ZEROING TARGET

(o) after firing is ceased, cock and release the bolts twice, set the machine guns at the maximum elevation angle, turn off the electric trigger switch and brake the turret mount;

(p) determine the mean impact point (MIP) for the burst of each machine gun on the target. To determine the mean impact point (Figs 140 and 141), do the following:

1. Draw horizontal line I-I, so that number of bullet holes on both sides of this line as well as distance B_1 and distance B_2 to the bullet holes located close to this line are equal.

2. Draw vertical line II-II so that number of bullet holes on both sides of this line and distance A_1 and distance A_2 to the bullet holes located close to this line are equal.

Intersection of horizontal (I-I) and vertical (II-II) lines is the mean impact point.

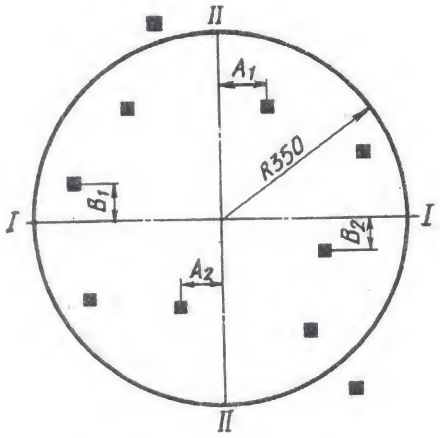


FIG. 140. DETERMINING MACHINE GUN КПВТ BURST MEAN IMPACT POINT AND CLOSE PATTERN

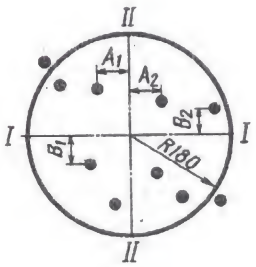


FIG. 141. DETERMINING MACHINE GUN ПКТ BURST MEAN IMPACT POINT AND CLOSE PATTERN

Draw a circle with the radius of 350 mm around the mean impact point of the burst of the КПВТ machine gun and of 180 mm around that of the ПКТ machine gun. At least 8 bullet holes must be within each circle (R-80). If the close pattern of the КПВТ machine gun is unsatisfactory, brake the turret mount more reliably or replace the machine gun barrel and repeat the firing procedure. The close pattern of machine gun КПВТ is considered unsatisfactory and the life of the barrel is considered expired in case the radius of dispersion is more than 2.5 times greater than the initial one (350 mm) or in case oval and side hits exceed 50 per cent.

In case of the unsatisfactory close pattern of the ПКТ machine gun, check it for correct adjustment and tighten the carriage adjusting mechanism; then repeat the firing procedure.

If the close pattern is again unsatisfactory, replace machine gun ПКТ. The close pattern of machine gun ПКТ is considered unsatisfactory and the life of its barrel is considered expired if the radius of dispersion is more than 2.5 times greater than the initial one.

3. After a satisfactory close pattern is attained, fire two more bursts of 10 shots of each machine gun. Use the data of three bursts of each machine gun, determine the close pattern of each burst, the mean impact point of each burst and the actual mean impact point of the three bursts for each machine gun (Figs 140, 141 and 142).

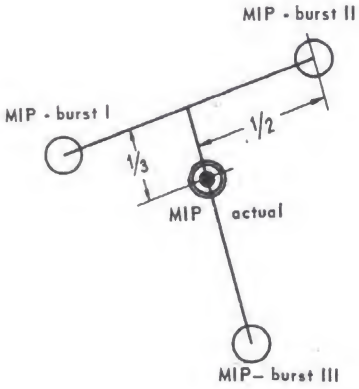


FIG. 142. DETERMINING MEAN IMPACT POINT OF MACHINE GUN THREE BURSTS (ACTUAL MIP)

4. Fire accuracy is considered satisfactory if the mean impact point of the three bursts is within the circle having a radius of not more than 135 mm for the КПВТ machine gun and not more than 60 mm for the ПКТ machine gun.

5. If in the course of firing the machine gun firing accuracy proves to be unsatisfactory, make necessary adjustments on the ПКТ machine gun and the sight.

In adjusting the ПКТ machine gun, turn forward the bushing of the adjusting mechanism which is on the side of deflection of impact mean point from the reference point. Prior to that, turn back the bushing which is on the other side. Turning the bushing by one division shifts the mean impact point by 100 mm, i.e. 1 mil.

This done, secure the ПКТ machine gun and sight and fire until a satisfactory result is attained. Then lock the bushings of the carriage adjusting mechanism with safety wire.

Note. When zeroing the turret mount machine guns on the vehicle which has run more than 15,000 km, it is allowed to increase the fire accuracy circle radius for machine gun КПВТ to 160 mm and that for machine gun ПКТ to 70 mm. It is also permissible in this case to increase the close pattern circle radius (R-80) for machine gun КПВТ to 400 mm and that for machine gun ПКТ to 200 mm (see Figs 140, 141 and 142).

Upon firing, elevate the turret mount to the maximum angle, unload the machine guns, cock and trigger each machine gun two times for the purpose of checking, and turn off the electric trigger switch and protective glass heater switch. This done, wipe the machine gun bores and lubricate them with gun grease. Remove the ammunition boxes from the box holders and put them in the racks, take off the deflector bag and discharge empty cases and belt links, place the belts into empty ammunition boxes, reinstall the deflector bag in its working place, lock the turret mount in the traveling position and put on the canvas covers.

Drawing Up of Testing Target

After zeroing the turret mount machine guns, draw up the testing target individually for each turret mount. To draw up the testing target, proceed as follows:

(a) position the vehicle in the same manner as when checking the position of the axes of the machine guns and sight (see above);

(b) set the machine guns in the horizontal position pointing them forward and brake the turret mount;

(c) install a board with a sheet of paper at a distance of 20 m from the flash hider of the КПВТ machine gun at the height of the axes of the machine gun bores;

(d) use the boresighting gauge to mark the points on the sheet of paper that are aligned on the axes of the machine gun bores. Perform sighting through the boresighting gauge three times. Also mark a point aligned on the apex of the sight reticle angle. Draw crosses for the machine gun bores and the aiming mark for the sight (Fig. 143).

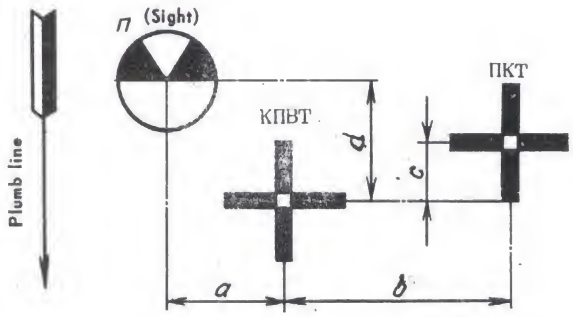


FIG. 143. TESTING TARGET FOR 20-m RANGE

For convenience of making the sighting marks, it is advisable to use an aiming disc with a hole for the pencil in the centre. Aim on the centre of the disc which is being manually shifted on the sheet of paper until the disc centre is aligned on the corresponding axis of the machine gun bore or the sight reticle angle apex. After plotting the crosses and aiming mark, perform the final check of the plotting.

Upon drawing up the testing target, measure the values of coordinates a, b, c, and d (see Fig. 143). Enter the acquired data in the testing target diagram which must be enclosed in the Service Log.

Note. Adjustment of the machine guns and sight by testing targets and boresighting gauges borrowed from other vehicles is impermissible.

Checking the turret mount against the testing target is performed before each firing practice or combat in case firing accuracy of the machine gun is heavily deteriorated, or after long marches. If the sight has been removed and then reinstalled, it must be adjusted.

To adjust the sight, proceed as follows:

(a) position the vehicle in the same manner as when checking parallelism of the axes of the machine guns and sight (above);

(b) check the machine guns and the sight for proper fastening;

(c) install plumb the board at a distance of 20 m from the flash hide of the КПВТ machine gun. Set the testing taregt on the board at a level of the axes of the machine gun bores;

(d) use the elevating and traversing mechanisms and the boresighting gauge to lay the КПВТ machine gun on testing target cross designated "КПВТ";

(e) brake the turret mount;

(f) insert the boresighting gauge in the bore of the ПКТ machine gun and check alignment of the boresighting gauge crosshair with the testing target cross designated "ПКТ". If the boresighting gauge crosshair is aligned on the target cross, the position of the ПКТ machine gun is not disturbed. If the boresighting gauge crosshair is not aligned on the testing target cross designated "ПКТ", unlock the bushings of the adjusting mechanism and adjust the machine gun position so that the boresighting gauge crosshair and the cross are aligned.

After adjustment, lock the adjusting mechanism bushings with safety wire.

The apex of the sight reticle angle must be aligned on the centre of the aiming mark "П" on the testing target. If the marks are aligned, the sight position is not disturbed. If the marks are not aligned, adjust the sight in compliance with the instructions given on page 200.

Remove the boresighting gauges from the bores of the machine guns and place them into the cases. Secure the cases in assigned places inside the vehicle.

Care of Turret Mount

General

1. When on march, the vehicle turret mount should be protected by canvas covers and locked in the traveling position.

2. Keep all the mechanisms of the turret mount clean and serviceable. Wipe the painted surfaces of the turret mount with dry waste and coat the phosphatized outer parts with a thin film of lubricant. See that the lubricant does not get onto the friction surfaces of the turret race brake and elevating mechanism brake as well as onto the slip ring. Wipe oil if it gets accidentally on the brake surfaces.

3. When preparing the vehicle for run, check the ammunition boxes for reliable fastening and adjust the length of the turnbuckles, if necessary.

4. Protect the mechanisms and parts of the turret mount from impacts, paying particular attention to safety of the ammunition boxes, empty case-and-link ejection chutes, trays, turret race guard, shield packing, and rollers of the retracting mechanisms, since dents, nicks and other defects of the parts will cause stoppage in firing and depressurization of the turret mount.

5. Set the gas regulator of the new ПКТ machine gun at figure 2. Reset the gas regulator after three thousand shots at figure 1. Further on, if stoppage occurs due to failure of the recoil parts of the machine gun to reach the extreme rearward position, it is permissible to set the gas regulator at figures 2 or 3.

When setting the gas regulator, see that the clearance between the gas regulator shoulder and the gas chamber wall is 0.3 to 1.5 mm.

6. Replace the defective parts with the parts taken from the individual SPTA set.

7. After firing and every 6000 km of run, check the attachment of the turret race, cradle, elevating and traversing mechanisms, empty case-and-link ejection chutes and ammunition box holders, and see that alignment of the machine guns and sight is not disturbed. In case the alignment is disturbed. adjust parallelism of the machine guns and sight by making use of the testing target. Checking of the machine gun and sight against the testing target should be performed after long marches when real or practice fire is anticipated.

8. The number of shots fired by the turret mount, kilometrage of the vehicle and data on repair or replacement of parts and units of the turret mount must be entered in the Service Log.

9. After every firing, clean, lubricate and inspect the machine guns.

Lubrication of Turret Mount

The Manufacturer issues the turret mounts with the machine guns slushed with lubricant ГОИ-54П, GOST 3276-74.

After firing and cleaning, lubricate the axles of rollers and cable of the retracting mechanism, the guides of recoil mechanism, the pin of the rear attachment point of the КПВТ machine gun and the carriage of the ПКТ machine gun with rifle grease.

Lubricate the turret race balls, internal parts of the traversing and elevating mechanisms, and the bearings of the turret shield with lubricant ЦИАТИМ-201 during repair or disassembly of the unit.

Do not lubricate the elevating arc, driving gear of the elevating mechanism, toothed rim of the turret race and driven gear of the traversing mechanism, as dust and sand trapped by oil lead to premature wear of friction surfaces.

Loading of Machine Gun Belts

The machine gun belts should be loaded under conditions that preclude contamination. Distorted links of the belts and defective cartridges must be disposed of. Before loading the belt, wash it twice in gasoline and dry it. Both washing and drying of the belt must be done outside the vehicle, in the open.

During Daily Maintenance and before firing, check the cartridges for correct setting in the belt links. The cartridges must uniformly enter the belt links. If non-uniform entry of cartridges in the loaded belt of the КПВТ machine gun is detected, align them with the cartridge aligner furnished with the turret mount. The cartridges in the loaded belt of the ПКТ machine gun are aligned manually.

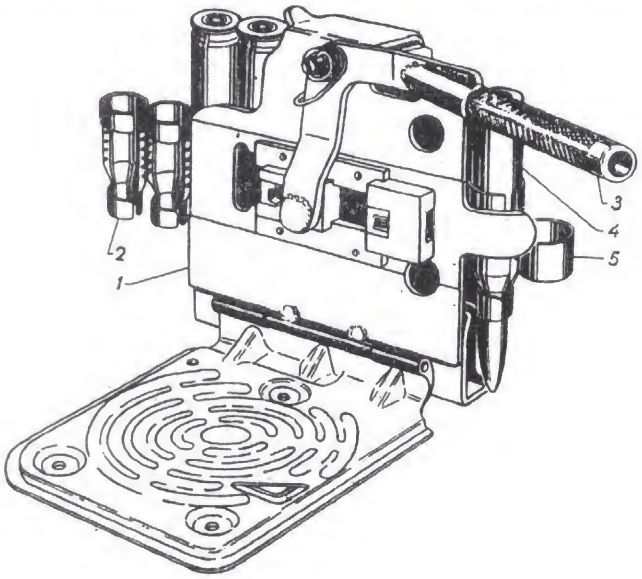


FIG. 144. USE OF CARTRIDGE ALIGNER
1 – aligner body; 2 – link; 3 – handle; 4 – cartridge; 5 – end link

Loading of the belt and aligning of cartridges for machine gun КПВТ is performed as follows: insert cartridges 4 with the bullet facing downwards into belt links 2 (Fig. 144) which are the closest to the empty end link. Bring the cartridges under the aligner pusher between the aligner cheeks. Then grip aligner handle 3 with the right hand insert the remaining cartridges into the belt links with the left hand. On doing this, raise and lower the aligner handle up to the stop with an energetic effort to align the cartridges in the belt. Raising the handle shifts the belt by one link. When the handle is lowered, the cartridge is rammed by the pusher into the link seat.

An ammunition belt for 50 cartridges is composed of 5 separate belts, each containing 10 cartridges. The belts are interconnected by a cartridge inserted into coupling end links 5.

The loaded belt is placed in the ammunition box in serpentine with bullets facing forward. See that the opened cover of the box is flapped to the right.

Loading of the ПКТ machine gun belts should be performed with a special Rakov's belt loading machine furnished with the turret mount.

To load the belt, proceed as follows:

(a) use screw clamp 6 (Fig. 145) to secure the loading machine on a board, on a table or in the recesses of the casing;

(b) open feed block 4 and insert belt 5 on the left side so that the link heads are facing down and the first link is against the rammer;

(c) fill bin 2 with cartridges (with bullets facing any side of the bin);

(d) smoothly rotate handle 1 clockwise with the right hand while adding cartridges in the bin and correcting them with the left hand. Rotate the handle without heavy efforts or jerks and do not jerk the handle backward;

(e) manually interconnect 10 loaded sections of the belt links with cartridges. Slightly shake the loaded belt to see that no cartridge falls out.

2. Unfasten the cradle traveling lock.

3. Elevate the turret mount machine guns and brake the turret mount.

4. Check that the machine gun is not loaded. If loaded, unload it.

5. Remove the ammunition box from the box holder.

6. Turn the carriage latch so that it becomes disengaged from the ear of the carriage base and release the carriage casing. As a result, the tooth of the shock absorber stem will get out from the carriage hole.

7. Shift the machine gun backward until the carriage guides leave the recesses of the carriage base.

8. Holding the machine gun, remove it jointly with the carriage.

9. Remove the axles and detach the carriage from the machine gun.

10. Remove the machine gun packing from the barrel.

11. Insert the axles into the carriage.

12. Reinstall the carriage in its place.

13. Lift the carriage casing and fasten it with the latch.

14. Set the turret mount machine guns in the horizontal position.

To install machine gun ПКТ, proceed as follows:

1. Elevate the turret mount machine guns and brake the turret mount.

2. Unlock the latch and lower the carriage casing.

3. Remove the carriage.

4. Remove the machine gun axles from the carriage.

5. Secure the machine gun on the carriage.

6. Mount the machine gun packing on the barrel.

7. Place the carriage with the machine gun into the carriage base (the machine gun safety lock must be in position FIRE (ОГОНЬ).

8. Lift the carriage casing and lock it with the latch.

9. Connect the electric trigger plug connector.

10. Cock the machine gun bolt.

11. Cut in the vehicle mains and turn on the switch on the turret board.

12. Depress the RH push button; as a result, the machine gun electric trigger will operate.

13. Set the cradle in the horizontal position and lock it with the traveling lock.

Removal and Installation of Machine Gun КПВТ

To remove machine gun КПВТ, proceed as follows:

1. Turn off switch ELECTRIC TRIGGERS (ЭЛЕКТРОСПУСКИ) on the turret board and disconnect the electric trigger plug connector.

2. Unfasten the cradle traveling lock.

3. Elevate the turret mount machine guns and brake the turret mount.

4. Check that the machine gun is not loaded. If loaded, unload it.

5. Check to see that no empty cases are left in the tube of the empty case ejection chute. Remove, if any.

6. Remove the ammunition box from the box holder.

7. Screw off the lock and throw aside the bracket collar cap.

8. Remove four screws that secure the machine gun sealing cup.

9. Detach the barrel from the receiver. To do that, set the machine gun moving parts in the extreme rearward position, depress the barrel latch and turn the barrel to the right up to the stop with the wrench available in the machine gun SPTA set.

10. Turn the cover of the empty case-and-link jeection chute of machine gun ПКТ to the inside of the housing of the empty case-and-link ejection chute,

11. Trigger the bolt while braking it with the retracting handle.

12. Remove the retracting mechanism roller from the machine gun.

13. Lift the RH and LH levers of the recoil mechanism locks.

14. Shift the machine gun receiver with the recoil mechanism backward until the guides of the collar and the pin leave the cradle grooves.

15. Remove the machine gun receiver jointly with recoil mechanism.

16. Open the receiver cover and shift it aside.

17. Screw off the lock and flap aside the collar cap;

18. Detach the collar with the recoil mechanism from the receiver.

19. Detach the tray from the machine gun feed block.

20. Set the receiver cover in the operating position.

21. Close the recoil mechanism collar cap.

22. Set the collar with the recoil mechanism in the operating position.

23. Set the cradle in the horizontal position and fasten the traveling lock.

To install the КПВТ machine gun on the cradle, proceed as follows.

1. Unfasten the cradle traveling lock.

2. Elevate the cradle and brake it.

3. Remove the collar with the recoil mechanism from the cradle.

4. Open the recoil mechanism collar cap.

5. Open the receiver cover and shift it aside.

6. Install the collar with the recoil mechanism on the machine gun receiver so that the collar plunger enters the seat in the receiver.

7. Close the collar cap.

8. Install the tray into the machine gun feed block so that the cover plate faces upwards.

9. Set the receiver cover in the operating position.

10. Lift the RH and LH levers of the recoil mechanism locks.

11. Install the receiver with the recoil mechanism. See that the eyes of the recoil mechanism enter the ears of the cradle. When installing the receiver, protect the cradle surface against damage.

12. Lower the levers of the recoil mechanism locks. As a result, the locks must get into the holes of the eyes and the cradle ears.

13. Turn the cover in the empty case-and-link ejection chute to set it in the operating position.

14. Install the retracting mechanism roller in the machine gun.

15. Set the machine gun moving parts in the extreme rearward position.

16. Open the bracket collar cap.

17. Install the barrel in the machine gun receiver. For this purpose, mount the barrel in the receiver so that the barrel casing handle is at the top, then use the wrench to turn the barrel from right to left and lock the barrel with the latch.

18. Close the bracket collar cap.

19. Check the clearance between the barrel casing and the collar. Adjust the position of the collar, if necessary.

20. Install the sealing in its place and screw in four screws that secure the sealing cup.

21. Connect the electric trigger plug connector.

22. Cut in the vehicle mains with the switch on the turret board.

23. Press the LH push button. As a result, the machine gun electric trigger must operate.

24. Set the cradle in the horizontal position and fasten the traveling lock.

Removal and Installation of Ammunition Boxes

To remove the ammunition boxes, proceed as follows:

1. Depress the box holder latch. In doing so, hold the ammunition box with one hand and let it get down a little to prevent the released latch from engaging the box plate.

2. Remove the ammunition box from the box holder.

3. Place the ammunition box in the rack and secure in position.

To install the ammunition box proceed as follows:

1. Remove the ammunition box from the rack.

2. Place the ammunition box in the box holder; as a result, the latch should engage the box plate.

3. Take the belt out of the box and place the first cartridge of the belt on the box tray.

Removal and Installation of Deflector Bag

To remove the deflector bag, proceed as follows.

1. Unlock the latch.

2. Remove the deflector bag from the brackets.

3. Take the empty cases and cartridge belt links of machine guns КПВТ and ПКТ out of the deflector bag.

To install the deflector bag, proceed as follows.

1. Place the deflector bag in the brackets.

2. Set the deflector bag in the horizontal position, and lock it with the latch.

TURRET MOUNT TROUBLES AND REMEDIES

Symptom and cause	Remedy
No hits: maladjusted sight or machine gun ПКТ	Align the sight and machine gun against testing target or carry out zeroing of turret mount machine guns
Fire stoppage: (a) binding of belt in ammunition box;	Replace ammunition box or straighten dents on it
(b) blocked link ejection chute of machine gun КПВТ or empty case-and-link ejection chute of machine gun ПКТ;	Remove deflector bag and empty it. Reinstall deflector bag
(c) seized link of ammunition belt in machine gun feed block;	Replace bent or broken links of ammunition belt
(d) uneven loading of cartridges in ammunition belt;	Pass ammunition belts of machine gun КПВТ through cartridge aligner. Align ammunition belts of machine gun ПКТ manually
(e) empty links in ammunition belt;	Load ammunition belt completely
(f) empty case of machine gun ПКТ nozzled lower rib of feed opening in empty case-and-link ejection chute	Remove jammed case

Continued

Symptom and cause	Remedy
Retracting mechanism of machine gun КПВТ fails to operate: broken cable or its terminated end	Replace defective cable
With sight brightening switch turned on, sight scale is not lit:	
(a) burnt lamp;	Replace lamp
(b) broken circuit	Check and correct circuit as indicated in Chapter 9
With its switch turned on, dome light or turret board lamp fails to glow:	
(a) burnt lamp	Replace lamp
(b) broken circuit	Check and correct circuit as indicated in Chapter 9
Incomplete retraction in cocking machine gun КПВТ:	
(a) defective link in ammunition belt;	Replace section of belt having defective link
(b) swift and complete retraction of moving parts is impossible	Unload machine gun (push cartridge into case ejection chute)
Binding of ammunition belt of machine gun КПВТ in tray:	
(a) tray in receiver is improperly installed (turned through 180° so that its pad faces downwards;	Install tray properly (with its pad facing upwards)
(b) distorted link ejection chute	Check and restore clearance (0.3 to 3.2 mm) between tray and link ejection chute
Loss of tightness of fighting compartment:	
(a) empty case of machine gun КПВТ stuck between gate and end piece of case ejection chute	Push empty case out of turret
(b) opening in shield packing is not stopped by rubber plug	Plug closing in shield packing
(c) empty case ejection chute gate is bent	Straighten gate

The crew delivers hand arms fire through oval firing ports in the vehicle hull side plates.

To protect the neighbouring crewman from being injured by a fired cartridge case, install case deflector 2 (Fig. 146) supplied along with the vehicle, on the submachine gun prior to shooting.

When firing is over, remove the case deflector from the submachine gun and secure it at the assigned place which is located near each portable (Fig. 147).

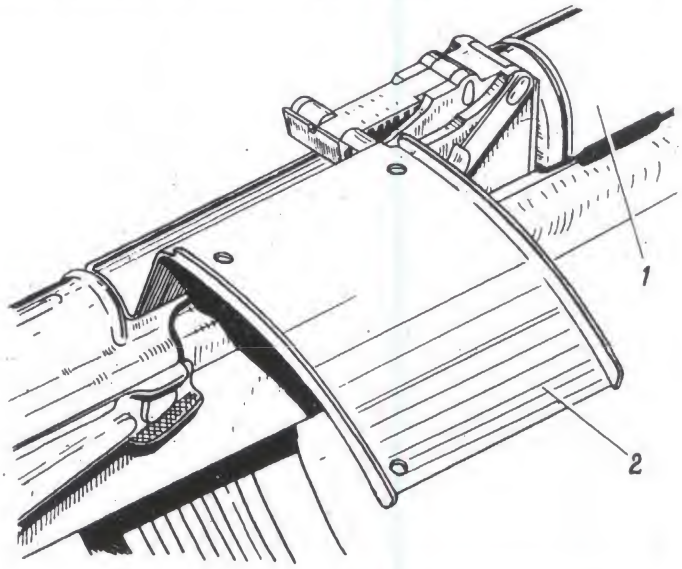


FIG. 146. INSTALLATION OF CASE DEFLECTOR ON SUBMACHINE GUN AKM
1 – submachine gun; 2 – case deflector

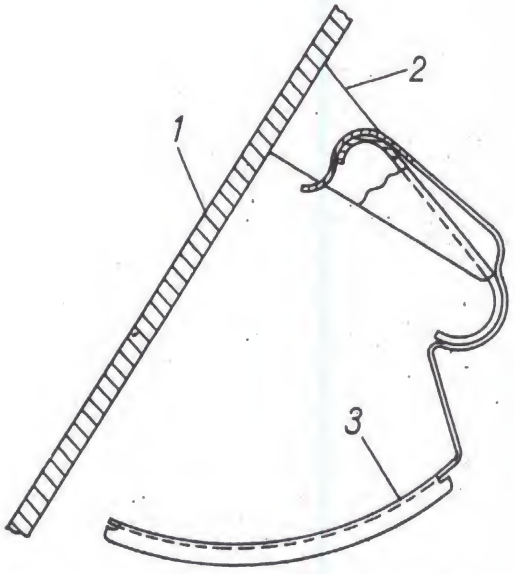


FIG. 147. FASTENING OF CASE DEFLECTOR IN VEHICLE
1 – hull plate; 2 – bracket; 3 – case deflector

Chapter 13

TOOLS AND ACCESSORIES

The vehicle tool kit consists of standard driver's and special tools supplied with the vehicle.

In the process of vehicle servicing, the special tools should be used only according to their direct purpose.

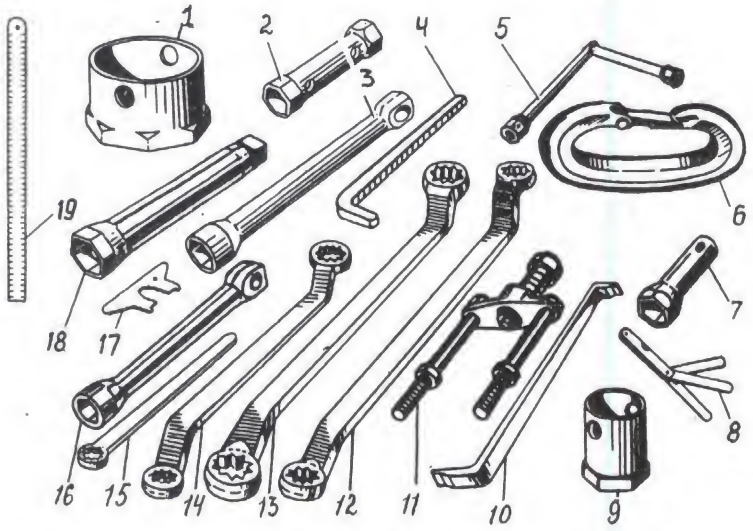


FIG. 148. SPECIAL TOOLS

1 – wrench for wheel hub bearing nuts; 2 – spark plug wrench; 3 – wheel nut wrench; 4 – wrench for transfer case plugs; 5 – wrench for air cock and brake bleeding (10x6); 6 – towing link; 7 – wrench for pendulum lever shaft nut; 8 – combination-type feeler gauge; 9 – wrench for nuts of auxiliary wheel axles; 10 – screwdriver for steering arm link plug; 11 – propeller screw puller; 12 – wrench, box-end, double-head (19x22); 13 – wrench for spring U-bolt nuts and hull bottom plugs (24x30); 14 – wrench for cylinder head nuts (17x19); 15 – wrench for exhaust manifold and lock nut of parking brake shoe adjusting bolt; 16 – wrench for compressor nuts; 17 – wrench for nut of filter rotor casing of centrifugal oil cleaner; 18 – wrench for engine crankcase oil drain plug (17x30); 19 – measuring rule, 300 mm

Tyre irons available in the tool kit may be used as tommy bars for special wrenches 1, 3, 7, 9 and 16 (Fig. 148), and the adjustable wrench in connection with the 17-mm square attachment is used as a tommy bar for wrench 18. A drift available in the driver's tool kit serves a tommy bar for spark plug wrench 2.

Detailed list of tools and accessories with indication of their stowage place is given in the Standard Equipment List which is a part of the vehicle operation papers.

JACK

The vehicle is furnished with a 5-tf hydraulic jack (Fig. 149).

For lifting one of the wheels, set the jack under the axle close to the wheel to be lifted. In case of a soft ground, place the jack pad or a strong board under the jack. Manually screw off screw 2 until head 1 thrusts against the axle to be lifted

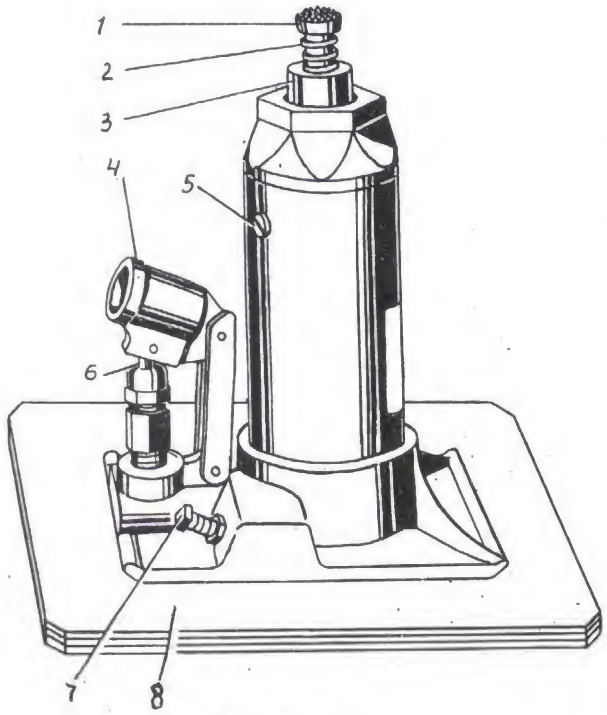


FIG. 149. JACK

1 – screw head; 2 – screw; 3 – working plunger; 4 – handle; 5 – plug; 6 – delivery plunger; 7 – obturating needle; 8 – jack pad

and turn obturating needle 7 clockwise as far as it will go.

Insert a tommy bar in handle 4 and drive the tommy bar up and down to lift the plunger to the required height. If the jack fails to hoist, screw off the obturating needle and make several up-and-down strokes with the tommy bar to bleed air that probably got inside the working cavity of the jack.

For lowering the wheel, gradually turn obturating needle 7 counterclockwise.

In using and storing the jack, observe the following rules:

1. Never get under the jacked-up vehicle. If this is necessary, place strong and stable trestles under the vehicle hull prior to the action.

2. When storing the jack, screw in its screw, lower the working and delivery plungers and give the obturating needle 1 or 2 turns back.

3. Remedy the jack troubles in due time.

Seepage of oil from the plungers and obturating needle must be eliminated by tightening the nuts of oil seals. Leakage of oil through the joints of the housing parts should be eliminated by tightening the jack housing cap. Worn oil seals should be replaced.

Bleeding of air from the jack working cavity should be effected in the following way: give the obturating needle 1.5 or 2 turns back and manually lift the hoisting plunger to its complete height by pulling the head screw; then lower the plunger right home. Repeat this operation 2 or 3 times and check the jack for operation. Failure of the jack to operate or slow hoisting is the symptom of presence of air in the operating cavity. To prevent air from getting into the jack operating cavity, do not pull the plunger by hand when the obturating needle is screwed in.

Incomplete lifting of the jack hoisting plunger results from insufficient amount of oil. The oil level must reach the filler hole closed by plug 5.

Failure in operation may also be caused by penetration of dirt inside the jack. For cleaning of dirt screw out the jack housing cap, drain oil and fill the housing with clean kerosene, and pump the jack with the obturating needle unscrewed. This done, drain kerosene and pour in oil.

4. Only clean filtered oil АМГ-10 and instrument oil МВП must be used in the jack. Never use oil of other grades or fluids of a kind, including the brake fluid.

Note. During operation in the areas where the ambient temperature may be below 40°C, fill the jack with oil АМГ-10 only. In case the jack is filled with oil МВП, replace this oil with oil АМГ-10 on having washed the jack with kerosene as described above.

LEVER-PLUNGER GREASE GUN

The lever-plunger grease gun is intended for manual pressure lubrication of the vehicle units provided with lubrication fittings.

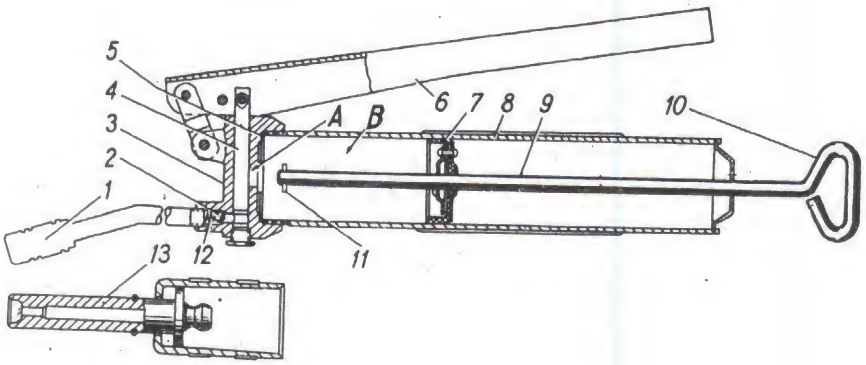


FIG. 150. LEVER-PLUNGER GREASE GUN
1 – main nipple; 2 – ball valve; 3 – cover; 4 – plunger; 5 – gasket; 6 – lever; 7 – piston; 8 – housing; 9 – rod; 10 – handle; 11 – pin; 12 – spring; 13 – auxiliary nipple; A – hole; B – chamber

For filling the grease gun, proceed as follows:

1. Screw cover 3 (Fig. 150) out of housing 8.
2. Use handle 10 to push piston 7 into housing 8 by 1/3 of its stroke.

Use a wooden plane to fill chamber B of the housing with lubricant. Then, push the piston again by 1/3 of its stroke and add lubricant. For the third time, push the piston right home and fully pack chamber B with lubricant. The capacity of the grease gun is 340 cm^3 of lubricant. When filling the grease gun with lubricant, see that no air is trapped in the chamber, for which purpose, tap some wooden object with the lower end of the grease gun (take care not to dent the grease gun). Penetration of air into grease gun chamber B hampers normal functioning of the grease gun.

3. Screw cover 3 on housing 8.

For using the grease gun, insert pin 11 into the slot of piston 7 and turn handle 10 counterclockwise. Then press the handle and set grease gun nipple 1 on the lubrication fitting. Pressing with the hand delivers lubricant from grease gun chamber B to the plunger space through hole A.

Moving of lever 6 imparts reciprocating motion to plunger 4.

When the plunger moves upward, the lubricant fills the space under the plunger through hole A. When the plunger moves down, ball valve 2 opens due to pressure built up by the plunger and the lubricant is forced through the pipe into nipple 1. As lever 6 is long and end face area of the plunger is small, a pressure of 350 kgf/cm^2 is built up in the grease gun which ensures passage of lubricant to all the units that need lubrication.

For lubrication of the universal joints, the grease gun is supplied with auxiliary nipple 13 to be fitted on basic nipple 1.

The universal joints of the water-jet propeller and winch drive must be lubricated with oil MT-16n. There is no need to clean the grease gun of old lubricant and fully fill it with oil. The grease gun may be partially filled with oil and pumped up. Lubricate the universal joints as soon as fresh oil comes off the grease gun.

OIL GUN

The oil gun which is used to pour oil into the vehicle assemblies is included in the vehicle tool kit (Fig. 151).

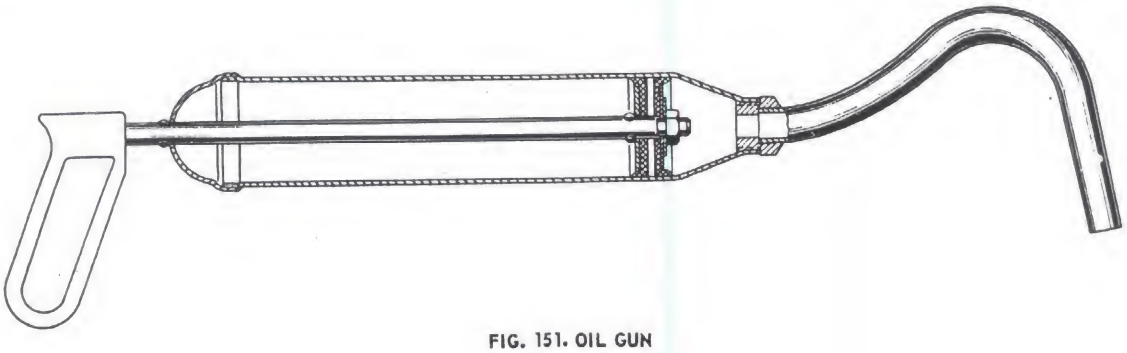


FIG. 151. OIL GUN

HAND-OPERATED FUEL TRANSFER PUMP

1. To transfer fuel with the pump, proceed as follows:

(a) dip the end of the hose into the vessel filled with the fuel to be transferred. See that the arrow on pump bulb 6 (Fig. 152) is directed upward. Dip the other end of the hose into the vessel receiving the fuel;

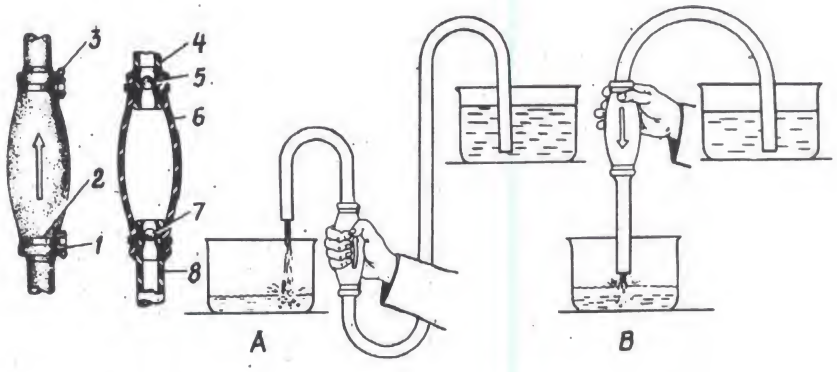


FIG. 152. HAND-OPERATED FUEL TRANSFER PUMP
1 – buckle; 2 – bracing band; 3 – cotter pin; 4 and 8 – hoses; 5 and 7 – valves; 6 – bulb

(b) operate the pump by squeezing and releasing bulb 6 (Fig. 152, A);

(c) as soon as fuel starts to flow, overturn the bulb so that the arrow is directed downward, stop squeezing the bulb and fuel will come by gravity (Fig. 152, B).

2. When necessary, the pump may be used to transfer fuel to a vessel located at a higher level. In this case, squeeze and release the bulb continiously.

3. After using the pump, be sure to drain fuel from it.

If the pump fails to operate due to clogging, do not disassemble it. To make it serviceable, it is sufficient to blow the pump through with compressed air.

ELECTRIC VULCANIZER

A 24-V electric vulcanizer, type 3BP-3, (Fig. 153) is used for repair of tyre tubes in case of break or puncture.

For vulcanizing of the tube, do the following: put an emeried patch of raw rubber of the required size on the thoroughly emeried damaged surface. Place the tube with the patch under the clamp of the electric vulcanizer so that the patch is on the side of the heater. Manually compress the tube with the patch by means of the screw clamp and connect the vulcanizer to the storage battery through the plug connector.

The process of vulcanization lasts 15 to 20 min depending upon the quality of raw rubber. After vulcanization, keep the patched tube under the screw clamp for 10 to 15 min until it is cool, and then remove it from the clamp.

It is not permissible to supply the electric vulcanizer with a voltage higher than 24 V. Nor it is permissible to tighten the screw clamp with a tommy bar, wrenches or other tools.

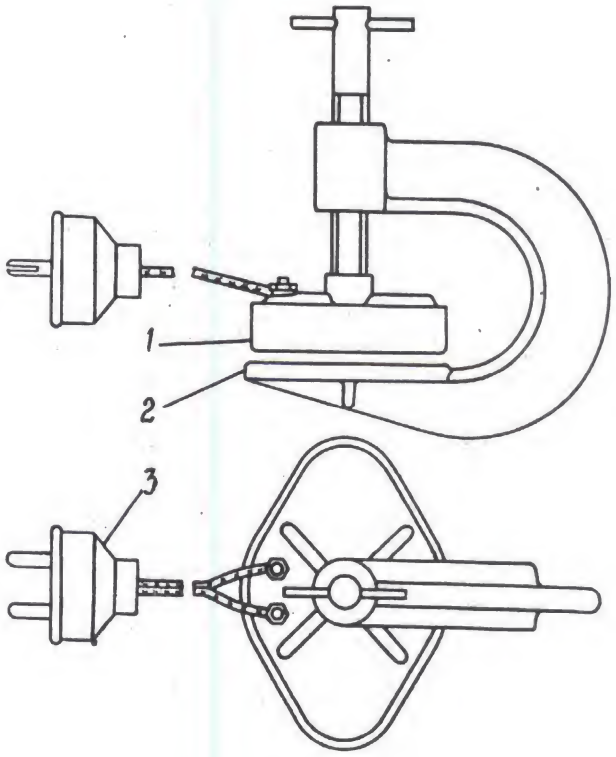


FIG. 153. ELECTRIC VULCANIZER
1 – heating element; 2 – screw clamp; 3 – connector plug

SURVIVAL AIDS

Used as survival aids on the vehicle are life jackets for each crew member.

The life jackets should be used only according to their purpose. Before the vehicle enters the water, remove the life jackets from the bag and put them on.

Never wear the life jackets when the vehicle is on land, and, the more so, when servicing the vehicle or performing repair or other operations.

Part II

OPERATING INSTRUCTIONS

Chapter 14

INITIAL PERIOD OF OPERATION

The first 1500 km of run are the initial period of the vehicle operation, during which the vehicle needs particular care. During the initial period, observe the following rules:

1. Do not overload the engine unless an urgent need arises, avoid driving the vehicle when its engine speed is maximum, avoid cross-country driving, do not operate the vehicle on water throttled-wide; do not drive the vehicle at a speed exceeding 60 km/h in the 4th gear, 35 km/h in the 3rd gear, 20 km/h in the 2nd gear, and 10 km/h in the 1st gear.

2. Pay particular attention to the condition of all fastening parts of the vehicle. Immediately tighten all loose nuts and bolts.

3. After the first 1000 km of run, do the following:

(a) tighten up the nuts of the cylinder block head studs (on cold engine) observing the sequence shown in Fig.3;

(b) check attachment of the axle drive reduction gear housings to the axle housings. Tighten the bolts, if required;

(c) check the starter, exhaust manifolds and clutch case for fastening;

(d) thoroughly perform operations of Preventive Maintenance No. 1. Besides, do check and tighten up, when required, the following fastening elements:

- nuts of spring U-bolts;
- nuts securing the flanges of the rear axle shafts;
- nuts securing the front axle spherical bearings;
- bolts and nuts securing the flanges of all the propeller shafts;
- nuts securing the steering knuckle lever;
- bolts securing the brake drums to the wheel hubs;
- nuts fastening the steering gear.

Chapter 15

STARTING AND STOPPING THE ENGINE

GENERAL

1. Before starting the engine after a halt, make sure there is no leakage of gasoline or gasoline smell inside the vehicle. Open the hatch covers to ventilate the hull interior.

2. When starting the engine with the starter, cut in the ignition (other preparatory operations are outlined in the Sections below), depress the starter button up to the stop and keep it depressed until the engine starts but never longer than 5 s. If firing occassionally takes place in the cylinders, the starter may be used continuously for 10 to 15 seconds.

3. Never depress the starter button intermittently as repeated engagement of the starter while the engine crankshaft rotates may result in breakage of teeth of the starter gear or of the flywheel rim.

4. A new attempt of the starter engagement is permissible in at least 5 to 10 s after the previous attempt when the engine crankshaft is completely stopped.

5. As soon as the engine is started, immediately release the starter button since the starter free-wheeling clutch is not rated for continuous operation.

6. Never start up the vehicle by operating the transmission with the starter via the engine. This may lead to breakage of the starter and storage battery.

It is necessary to distinguish the three cases of starting the engine:

(a) starting the warm (heated) engine;

(b) starting the cold engine when the ambient temperature is above 0°C;

(c) starting the cold engine at a low ambient temperature (below 0°C).

STARTING THE WARM ENGINE

1. Switch on the ignition.

2. Depress the starter button and keep it depressed until the engine starts running (keep it depressed for not more than 5 s).

While depressing the starter button, do not depress the accelerator pedal. Remember that each time the accelerator pedal is depressed the carburettor accelerating pump injects fuel. In case the engine is warm, this results in creation of overrich mixture and failure in starting.

Immediately after starting, perform multiple short-time throttling to make the engine idling speed stable and functioning of the starter interlocking relay more reliable.

If two or three attempts to start a warm engine with a serviceable ignition system failed, this is caused most frequently by creation of overrich mixture due to excessive fuel inleakage. To dilute overrich mixture, scavenge the engine cylinders with fresh air. For this purpose, switch on the ignition and slowly depress the accelerator pedal all the way down, and then press the starter button. Do not depress the accelerator pedal repeatedly since each time the accelerating pump delivers a new dose of gasoline into the carburettor mixing chambers and thus makes the mixture overrich.

If the throttled-wide engine fails to start, scavenge the cylinders and try to start the engine in the usual manner. If a warm engine does not start unless the choke valve is used, it means that the carburettor jets (and first of all, the idling jets) are clogged. In such case, remove and blow through the jets.

When starting a very hot engine and particularly the engine that has stalled due to overloading, or when starting the vehicle after a halt, it is advisable to depress the starter button and the accelerator pedal simultaneously. In this case, the engine cylinders will be scavenged after several revolutions of the crankshaft and the engine will be easily started.

STARTING THE COLD ENGINE AT AMBIENT TEMPERATURE ABOVE 0°C

1. Before starting the engine after long halts, always actuate the fuel pump hand-operated lever to prime gasoline into the carburettor in order to compensate possible loss of gasoline due to evaporation.

2. Pull off the throttle control knob or depress the accelerator pedal so that throttle valves of the carburettor open to approximately 1/5th of their full width.

3. Disengage the clutch by depressing the clutch pedal up to the stop. This unloads the starter as it becomes relieved of driving the gears of the gearbox enveloped by the thickened oil while cranking the engine crankshaft.

4. Switch on the ignition.

5. Depress the starter button. Do not keep the starter turned on for more than 5 s; when intermittent firing takes place in some of the cylinders, it is allowed to use the starter continuously for 10 to 15 s.

When starting the cold engine at an ambient temperature around 0°C, it is permissible to supply fuel into the intake manifold by depressing the accelerator pedal two or three times before switching on the starter. If the engine fails to start after that, enrich the mixture. To do this, close the carburettor choke valve by pulling the choke knob right off.

6. As soon as the engine starts operating, gradually push in the choke knob (if the choke valve was closed for starting), release the clutch pedal while simultaneously depressing the accelerator pedal at the same time. See that the engine does not gain excessively high speed.

If the engine fails to be started after three attempts, scavenge the cylinders with fresh air as described above in Section "Starting the Warm Engine" and make a new attempt of starting. If after three successive attempts no firing in the engine takes place, check the ignition and fuel systems for serviceability before renewing the attempts to start the engine.

Multiple and futile attempts to start the engine not only discharge the storage battery but also step up wear of the engine cylinders. Avoid over-choking as it makes engine starting exceptionally difficult!

Usual causes of difficult starting of the engine (provided the choke is properly used) are the following:

1. No supply of fuel to the carburettor.

2. Poor condition of the breaker contact points or incorrect gap between the points.

3. Spark plugs are defective (damaged insulators, electrodes and the like) or dirty.

4. Defective high- or low-tension wiring.

5. Leakage of high-tension current in the ignition distributor cap due to contamination inside and outside.

It is permissible to start moving the vehicle only after the temperature of water in the engine becomes at least 40°C.

Never operate the engine at a high speed and never drive the vehicle for a long time in the first or second gear with the purpose of speed-up warming of a cold engine.

STARTING THE COLD ENGINE AT LOW AMBIENT TEMPERATURE

To ensure reliable starting of the engine at a low ambient temperature and to considerably extend the service life of the БРДМ-2 vehicle, a starting preheater is mounted in it to the left of the engine (when viewed from the vehicle rear). The starting preheater filler funnel is located on the crossbeam inside the engine compartment.

If the ambient temperature is below 0°C, start the engine with the starting preheater (for starting procedure refer to Section below).

ENGINE STARTING PREHEATER

The main part of the engine preheater is a one-piece boiler which consists of four cylinders mounted one inside the other. These cylinders form flame tube 7 (Fig.154), two water jackets 5 and gas flue 6. The boiler water jackets permanently communicate with the engine cooling system.

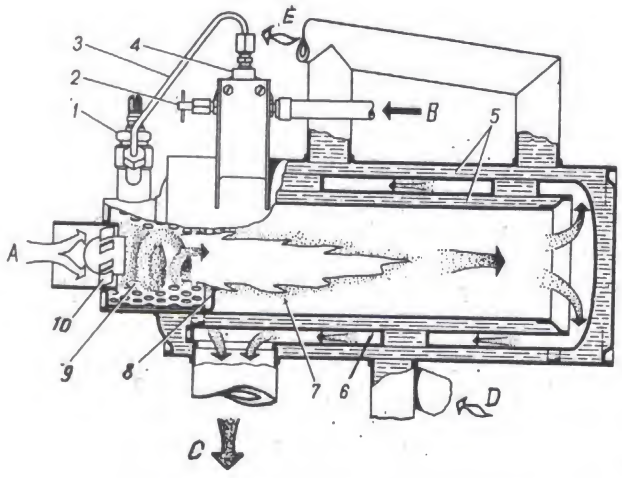


FIG. 154. STARTING PREHEATER BOILER. FUNCTIONAL DIAGRAM
1 – glow plug; 2 – electromagnetic valve adjustment needle; 3 – fuel pipe; 4 – electromagnetic valve; 5 – water jackets; 6 – gas flue; 7 – flame tube; 8 – diffuser; 9 – combustion chamber; 10 – swirler; A – air inlet; B – fuel inlet; C – exhaust duct; D – cold water inlet; E – hot water outlet

During starting the preheater when exhaust gate 20 is open (Fig. 157), gases go outside through the funnel of gas discharge branch pipe 19 and the hole in the vehicle hull bottom.

To actuate the preheater, close exhaust gate 20 by using rod 5. In this case hot gases from the side branch pipe of the preheater boiler come through exhaust casing 21 and heat oil in the engine crankcase.

The fuel is fed by gravity from the fuel tank via the electromagnetic valve into the combustion chamber. To ensure normal process of combustion (without smoke and soot), the electromagnetic valve is provided with adjustment needle 5 (Fig.155) that meters delivery of fuel. To ensure normal combustion of gasoline, the needle is adjusted at the Manufacturing plant in such a way that the flame torch does not project from the boiler

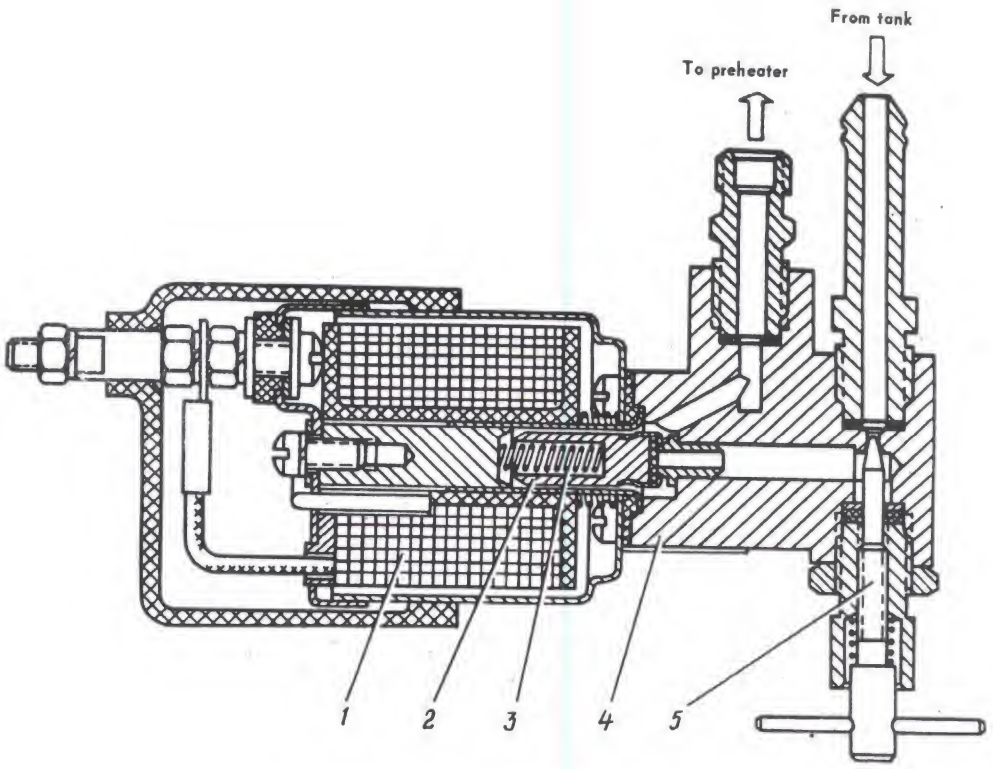


FIG. 155. ELECTROMAGNETIC VALVE. DIAGRAM
1 – valve coil; 2 – core and valve assembly; 3 – core spring; 4 – valve seat; 5 – adjustment needle

funnel and remains within the boiler funnel end portion. This requirement is met by screwing the adjustment needle in or off. It is not recommended to disturb the Manufacturer's needle adjustment. If in case of an utmost necessity the needle is readjusted, pay particular attention to observance of fire precautions (make sure that the boiler funnel is clean, the fire extinguisher is at hand, there is no oil or gasoline on the vehicle hull bottom, and so on).

The preheater fuel tank can be filled by two methods:

(a) with the engine fuel pump by manipulating the manual priming lever;

(b) with the hand-operated fuel transfer pump.

The remaining fuel is drained from the preheater tank by means of a three-way cock whose handle can be set in one of the three positions*:

(a) position 1: COCK SHUT OFF (КРАНИК ПЕРЕКРЫТ);

(b) position 2: PREHEATER OPERATION (РАБОТА ПОДОГРЕВАТЕЛЯ);

(c) position 3: FUEL DRAINED FROM THE PREHEATER TANK (СЛИВ ТОПЛИВА ИЗ БАЧКА ПОДОГРЕВАТЕЛЯ);

Air is forced into the combustion chamber by an electric blower mounted on the engine compartment bulkhead.

Initial firing of the fuel mixture is performed by the glow plug. After stable burning of fuel is attained in the combustion chamber, the glow plug gets off, and further burning of fuel is maintained by the ignited flame torch.

The preheater control box (Fig. 156) is located on the engine bulkhead on the side of the fighting compartment. Arranged on the control box are switch knob 4 of the electromagnetic valve and electric blower, pilot coil 3, glow plug switch 2, and 20-A protective device return button 5.

*See instruction plate on the engine bulkhead.

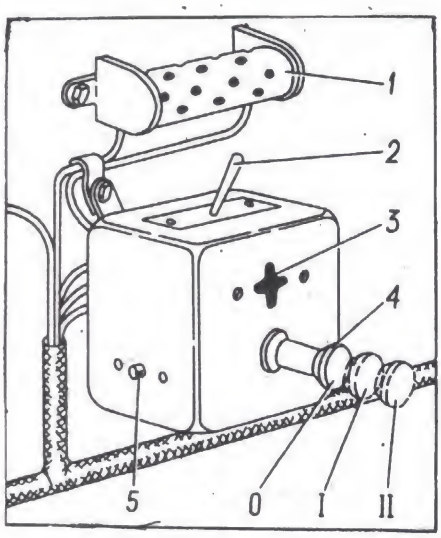


FIG. 156. PREHEATER CONTROL BOX
1 – ballast resistor; 2 – glow plug switch; 3 – pilot coil; 4 – knob of electromagnetic valve and blower switch; 5 – protective device return button

In case of overloading or short-circuit, protective device return button 5 springs out from the box body, thus breaking the circuit. After elimination of trouble, cut in the protective device by momentarily depressing return button 5. Do not keep the button depressed as it may cause breakage of the protective device if the trouble in the circuit is not yet eliminated.

Switch 4 has three positions:

(a) position 0: all units are switched off (the switch knob is depressed up to the stop);

(b) position I: the blower motor is switched on (the switch knob is pulled half-way off);

(c) position II: the blower motor is switched on and the electromagnetic valve is open (the switch knob is pulled off up to the stop).

Starting the Engine with Starting Preheater

1. Check and, if necessary, replenish the cooling system with antifreeze up to the normal level.

2. Screw out plug 18 (Fig. 157) in the hull bottom.

3. Fill fuel tank 13 of the preheater with gasoline. After filling the tank, shut cock 9 located on the engine fine fuel filter. In this way, the engine fuel line will be disconnected from the preheater tank.

4. Set three-way cock 14 in position PREHEATER OPERATION by turning the handle leftwards.

5. Remove cap 1 of the air inlet branch pipe.

6. Make sure that gas exhaust gate 20 is open (rod 5 is in the lowermost position).

7. With the air inlet and outlet doors opened, scavenge the preheater boiler. For this purpose, pull knob 4 on the control box half-way off (position I).

8. In 1/2 to 1 min, switch off the blower by fully depressing knob 4 (position 0).

9. Start the preheater. For this purpose, proceed as follows:

(a) switch on the glow plug;

(b) as soon as the pilot coil becomes light red thus showing that the glow plug is ready for operation, pull switch knob 4 on the control box right off (position II). As a result, the blower motor is switched on, electromagnetic valve is opened, and gasoline starts to come to the boiler. Getting on the red hot coil of the plug the atomized gasoline ignites which fact can be recognized by a pop in the boiler, and humming heard afterwards.

If in 3 to 5 s the preheater fails to start, return the switch knob to position 0 (OFF), scavenge the boiler, and repeat the starting;

(c) switch off the glow plug when stable operation of the boiler is attained. Burning of incoming gasoline will be maintained by the flame torch that has ignited.

10. Upon making sure that the preheater operation is stable, close exhaust gate 20 by shifting rod 5 upwards up to the stop. In this case, hot gases will go through exhaust casing 21 to heat oil in the engine crankcase.

11. When coolant in the engine is heated to 50 to 60°C and the oil temperature becomes as high as 35 to 40°C (as indicated by the temperature gauges on the instrument

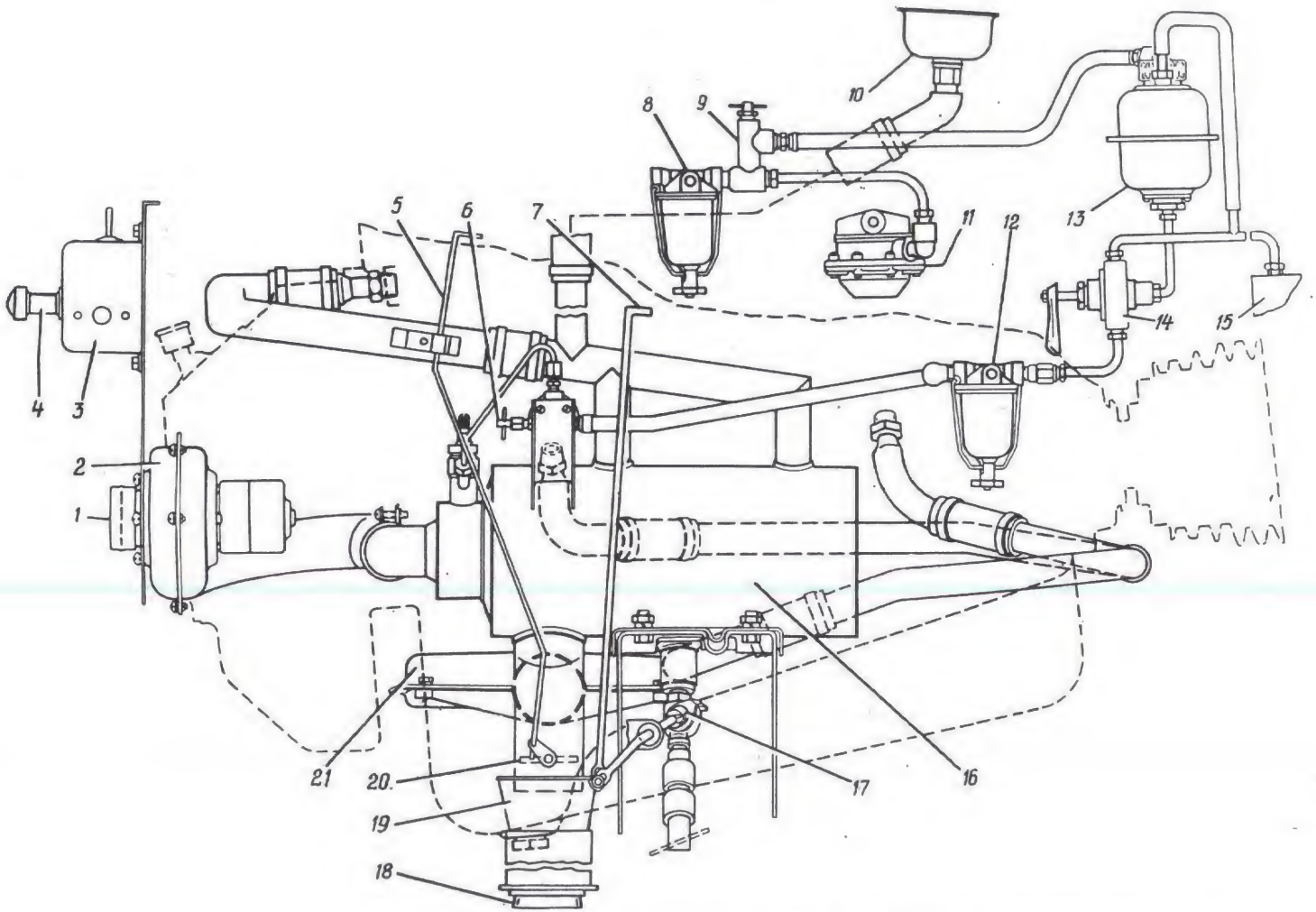


FIG. 157. ENGINE STARTING PREHEATER. INSTALLATION DIAGRAM

1 – air inlet branch pipe cap; 2 – electric blower; 3 – preheater control box; 4 – change-over switch handle; 5 – exhaust gate rod; 6 – adjustment needle; 7 – handle of drain cock control lever; 8 – engine fine fuel filter; 9 – cock; 10 – filling funnel; 11 – fuel pump; 12 – filter; 13 – fuel tank; 14 – three-way cock; 15 – vehicle LH fuel tank; 16 – preheater boiler; 17 – drain cock; 18 – hull bottom plug; 19 – gas discharge branch pipe; 20 – exhaust gate; 21 – exhaust casing

nel), start the engine as recommended in Section "Starting the Cold Engine at Ambient Temperature Above 0°C".

12. Set three-way gasoline cock 14 in position FUEL DRAINAGE FROM PREHEATER TANK.

After the humming of flame in the preheater boiler ceases, set knob 4 of the electromagnetic valve and electric blower switch in position I, and then in 25 to 30 s in position 0.

Inobservance of the above rules of preheater switching off may cause ejection of flame into the air inlet branch pipe.

13. Put on cap 1 of the blower air inlet branch pipe, shut off three-way cock 14, screw plug 18 in the hull bottom, open exhaust gate 20 with rod 5 and open the fuel system shut-off cock mounted on the engine intake manifold.

Bear in mind that in case of a low ambient temperature (-30 to -40°C) thickening of antifreeze in the outlet pipe may lead to high internal pressure in the boiler (crackling and clicks are heard). In this case make a 2 or 3-min interval after every 3 or 4 min of operation of the preheater.

If water is used as coolant, carry out the engine preheating in the following way:

(a) prepare 37 ℓ of water;

(b) perform the operations of Items 2, 3 and 4;

(c) close drain cocks of the cooling system and shut-off cock of the fuel system mounted on the engine intake manifold;

(d) screw out the plug of preheater filling funnel 10;

(e) perform the operations of Items 5, 6, 7 and 8;

(f) pour 1.5 ℓ of water into the starting preheater boiler through filling funnel 10;

(g) perform the operations of Item 9;

(h) let the boiler operate for 1 or 2 minutes, and then switch off the preheater. If for some reason or other the preheater fails to start operating, make a new attempt of starting it. If after even the third attempt the preheater is not started, drain water from the boiler and proceed with trouble-shooting. Then pour 1.5 ℓ of water into the boiler and switch on the preheater in the way outlined above;

(i) pour 3.5 to 4 ℓ of water into the preheater filling funnel. Screw in the filling funnel cap. Do not pour in too much water as it may get into the radiator lower tank and may get frozen there;

(j) start the preheater following the above procedure;

(k) carry out operations of Items 10, 11 and 12;

(l) operate the engine at medium speed and fill the entire cooling system with water through the expansion tank filler neck. Pour water slowly to let air escape from the cooling system;

(m) carry out operations indicated in Item 13.

How to Use Starting Preheater

1. When using the starting preheater, remember that careless handling as well as defects of the preheater may cause fire.

2. Allowed to handle the preheater may be only the driver who has deeply studied the present regulations.

3. The driver must be present during the engine preheating and watch burning of fuel in the boiler up to the moment the preheater is switched off. A fire extinguisher must be at hand to prevent any fire hazard.

4. Keep both the starting preheater and the engine always clean and serviceable because an oiled engine (and particularly oiled crankcase) and bottom of the vehicle hull or fuel leakage may cause fire.

5. Open the cock on the engine fuel fine filter only for the period of filling the tank with the aid of the fuel pump. After the tank is filled, close the cock securely to avoid overfilling of the tank during operation of the engine.

6. After preheating of the engine is completed, do not forget to drain the fuel remaining in the preheater tank to the main fuel tank of the vehicle and set the three-way cock in the COCK SHUT OFF position.

7. To facilitate starting of the engine with the preheater in extreme cold, it is advisable to close the blower inlet opening to about half of its clearance by hand at the moment of starting.

8. When filling the preheater fuel tank with the aid of the engine fuel pump, bear in mind that the cam of the engine camshaft may happen to stop against the pump lever. In this case the fuel pump will not deliver gasoline and the preheater fuel tank should be filled with the aid of the hand-operated fuel transfer pump. To ensure the possibility of filling the preheater tank by means of the engine fuel pump, it is recommended to check the fuel pump manual priming lever for good functioning before parking the vehicle.

9. Never operate the preheater without liquid in the boiler.

10. In case of difficult starting of the boiler, do not keep the switch knob in position II for more than 10 s as unburned fuel that runs into the boiler may ignite and cause blowout of flame from the boiler funnel; in its turn, it may cause fire.

11. When using the starting preheater and also when starting and warming up the engine indoors, take all measures to avoid poisoning by extremely toxic carbon monoxide gas.

Care of Starting Preheater

1. During Daily Maintenance, check to see that there is no leakage of coolant or fuel through the joints of pipelines, hoses and cocks. Immediately eliminate the disclosed defects.

2. During Seasonal Maintenance (in autumn), proceed as follows:

(a) remove the electromagnetic valve, disassemble, wash and clean its components: the valve base, outlet and inlet unions, adjusting needle, and armature. Thoroughly clean the surface of the valve armature of deposit so that it freely moves in the coil central opening.

Reassemble the electromagnetic valve and reinstall it;

(b) remove the glow plug and clean it of carbon deposit;

(c) wash the preheater boiler, pipes and drain cock with clean warm water. Flush out through the funnel until clean water starts to flow from the drain cock. When washing the boiler, check to see that the drain cock hole is clean as accumulation of scale may block the hole and prevent draining of water. Thoroughly clean the cock in this case;

(d) remove and wash the starting preheater fuel tank and gravitation filter in gasoline, and blow through the fuel pipes with compressed air;

(e) check and, if necessary, tighten up the bolts and nuts securing the preheater, fuel tank, gas discharge branch pipe, electric blower, and control box;

(f) clean wires of dust and dirt and check them for proper fastening.

PREHEATER TROUBLES AND REMEDIES

Trouble and cause	Remedy
Preheater fails to be started:	
(a) faulty glow plug or pilot coil;	Check and, if necessary, replace glow plug or pilot coil
(b) insufficient voltage of storage battery;	Recharge battery
(c) no delivery of fuel, electromagnetic valve fails to open	Check electric connections
(d) needle and passages of electromagnetic valve are blocked;	Blow through or, if required, disassemble and clean electromagnetic valve without disturbing needle adjustment
(e) voltage is not supplied to electric motor, glow plug, or electromagnetic valve coil	Check electric connections
Flame dies, burning fades:	
(a) too low delivery of fuel;	Clean fuel pipes, electromagnetic valve
(b) insufficiently opening electromagnetic valve;	Check voltage across coil (it should be at least 18 V). If necessary, disassemble valve and eliminate seizing
Heavy smoke getting through exhaust casing:	
(a) low speed of blower electric motor;	Check voltage across terminals of electric motor
(b) blocked blower intake opening;	Eliminate trouble
(c) formation of carbon deposit inside flame tube and gas flue	Blow through flame tube and gas flue with compressed air through the swirler branch pipe
Blower motor fails to rotate:	
(a) insufficient voltage across electric motor terminals;	Check and eliminate cause of voltage drop. If necessary, recharge storage battery
(b) broken or incorrectly connected wiring;	Check circuit according to diagram, eliminate breakage in wiring
(c) jammed electric motor shaft	Eliminate jamming of shaft or brushing of blower impeller

STARTING THE ENGINE WITH CRANK HANDLE

The crank handle is used for starting the engine at a low ambient temperature, for turning the crankshaft during adjustment of spark timing, and also when it is impossible to start the engine with the starter because the storage battery is discharged. The crank handle is inserted through a hole in the rear armour plate of the hull. The hole is closed with a plug. After starting the engine, do not forget to place the plug back.

CHECKING THE ENGINE OPERATION

In the course of the engine operation, watch the readings of the gauges to monitor the temperature of coolant in the cooling system, temperature and pressure of oil in the lubricating system, and charging current of the storage battery.

The coolant and oil temperature gauges should read the temperature of 80 to 90°C which corresponds to normal engine thermal conditions. If with the engine running at a stable speed the oil temperature does not reach the above value, cut out the oil coolers by using cock 2 (Fig. 5) arranged on the engine right side. Increase of the coolant temperature up to 105°C and oil temperature up to 110° for a short time (for not more than 5 min).

The maximum permissible pressure in the lubricating system (with the oil temperature of 80 to 90°C) is 5.5 kgf/cm^2. When the engine speed is 1200 r/min which corresponds to the vehicle speed of 35 km/h in the fourth gear, the pressure should be at least 1.5 kgf/cm^2 with the oil coolers cut in and 2 kgf/cm^2 with the oil coolers cut out. As the engine becomes worn, the pressure may decrease, but at the above speed should be at least 1 kgf/cm^2 with the oil coolers cut out. Never run the vehicle with a pressure below 1 kgf/cm^2 at a speed of 35 km/h or higher.

If the pressure gauge shows pressure below 1 kgf/cm^2 when the vehicle speed is 35 km/h, it is necessary to determine the actual pressure in the lubricating system as the pressure gauge installed in the vehicle has an accuracy of ±0.5 kgf/cm^2. To find the actual pressure, use the more accurate pressure gauge which can be included into the lubricating system instead of the oil pressure gauge sending unit arranged on the right side of the cylinder block (if viewed from the vehicle rear).

When the ignition is switched on, the pressure gauge pointer should come close to the "0" mark on the instrument scale. When the engine runs at idle, the pointer should deflect rightwards, thus indicating the presence of oil pressure in the system.

When power is consumed only for supplying the ignition system, the voltammeter pointer should deflect to the right, though it may stick at the zero division if the storage battery is fully charged.

STOPPING THE ENGINE

When the vehicle is stopped after running with heavy load, let the engine operate at a low idle speed for two minutes and then only switch off the ignition. This is necessary to ensure gradual and uniform cooling of the engine valves and other parts.

It should be remembered that carbon deposit, dirt or oiling of the spark plugs heavily aggravate engine starting. Long idle operation of the engine results in sooting of the spark plugs and failure in starting, whereas load operation of the engine cleans the spark plugs. Therefore, do not run the engine at idle for more than five minutes.

Avoid leaving the vehicle outdoors during frost for long unless a pressing necessity exists. Warm the engine periodically by operating it at idle. In such cases it is expedient to complete warming of the engine at idle with a short run so as to make the engine operate with a load after warming at idle.

Chapter 16

DRIVING THE VEHICLE

Prior to starting any operations of the vehicle, the driver should study and know well the location and designation of all the controls as well as the methods and technique of using them.

VEHICLE CONTROLS

Location of the vehicle controls are shown in Fig.158.

The steering handwheel with horn button 11, clutch pedal 9, brake pedal 10, accelerator pedal 12, gear-shift lever 15 and parking brake control lever 18 are arranged in compliance with the standard requirements.

The starter button is located on instrument panel 8.

Located to the left of the driver's seat are the transfer control levers: front axle control lever 7 and range (auxiliary gearbox) control lever 24. Located to the right and rear of the driver's seat are control lever 21 of the water-jet propeller power take-off and winch control lever 22.

Water-jet propeller shutter and splash panel control cock handle 2 and auxiliary wheels hoisting and lowering control cock handle 1 are located on the front wheel bay to the left of the driver's seat. Auxiliary wheels control lever 23 is located behind the driver's seat, close to the wheel bay.

Tyre cock unit 3, air reducer 4 of the tyre pressure control system and air bottles pressure gauge 5 are arranged on the left side in front of the driver, while switch 6 of air inlet and outlet doors control motor is located on the sloped armoured plate of the superstructure (hull upper portion).

Knob CHOKE (ПОДСОС) 20 and knob THROTTLE (ГАЗ) 19 are mounted to the right of the driver, between the vehicle commander's and driver's seats.

Mounted between the sight holes on the front armoured plate is windshield wiper switch 16.

Location of various switches and gauges on instrument panel 8 is given in Chapter 9, Section "Instrument Panel".

Steering of the armoured reconnaissance vehicle on land do not differ principally from steering of any cross-country vehicle. It is only necessary to take into consideration the overall dimensions and specific shape of the vehicle hull when making turns and passing by on-coming and over-taken vehicles.

The driver's seat has lengthwise adjustment mechanism, seat back tilt adjustment mechanism, and lifting mechanism ensuring three fixed positions of the seat.

The driver should select the position which is most convenient for steering the vehicle.

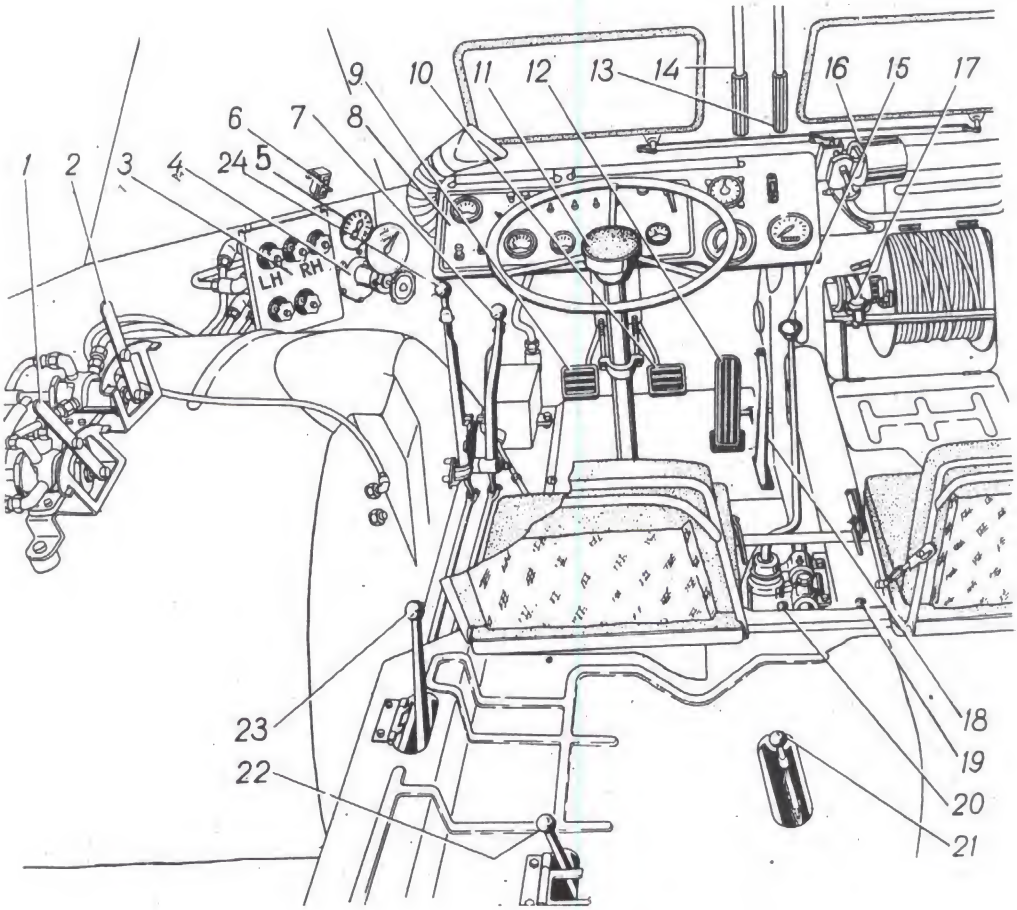


FIG. 158. VEHICLE CONTROLS

1 – handle of auxiliary wheels hydraulic system cock; 2 – handle of water-jet propeller shutter and splash panel hydraulic system cock; 3 – tyre cock unit; 4 – air reducer of tyre pressure control system; 5 – air bottles pressure gauge; 6 – switch of air inlet and outlet doors control motor; 7 – front axle control lever; 8 – instrument panel; 9 – clutch pedal; 10 – brake pedal; 11 – horn button; 12 – accelerator pedal; 13 – control handle of commander's armoured visor; 14 – control handle of driver's armoured visor; 15 – gear-shift lever; 16 – windshield wiper switch; 17 – handle of winch drum clutch; 18 – parking brake control lever; 19 – throttle valve knob; 20 – choke valve knob; 21 – water-jet propeller power take-off control lever; 22 – winch control lever; 23 – auxiliary wheels control lever; 24 – range control lever

DRIVING THE VEHICLE ON LAND

Placing the Vehicle in Motion

After the engine is warmed up so that the temperature of coolant is at least 40°C and the engine runs steadily, it is permissible to place the vehicle in motion.

To place the БРДМ-2 vehicle in motion, proceed as follows:

1. Depress the clutch pedal.

2. Engage the first speed gear.

3. Shift the parking brake system lever to the foremost position (thus completely releasing the brake system).

4. Smoothly release the clutch pedal and simultaneously depress the accelerator pedal to increase the engine speed.

5. Change the speed gears in succession and gather the speed permissible under the present traffic conditions.

Driver! Avoid long running in low gears!

When placing the vehicle in motion on upgrade, hold the vehicle with the parking brake, disengage the clutch, shift in the first speed gear and, while increasing the engine speed, smoothly but quickly engage the clutch and release the parking brake lever, giving the vehicle no time to roll back.

When placing the vehicle in motion on steep or long downgrade, hold the vehicle with the parking brake, disengage the clutch, shift in the first or second speed gear (depending on steepness of downgrade), then smoothly engage the clutch and release the parking brake. Start driving while slightly braking the vehicle with the service brakes and having the accelerator pedal completely released.

Gear Shifting

The technique of gear shifting in the БРДМ-2 vehicle does not practically differ from that used for transport automobiles. However, the БРДМ-2 vehicle has the gearbox remote control linkage with special gear shifting system which requires certain driver's skill in handling the remote control and great attention for accurate, silent and full engagement of speed gears. Before starting the vehicle, the driver must check the gearbox control linkage and the interlocking mechanism ensuring full (fixed) engagement of the speed gears, to make sure they are properly adjusted (see Chapter 3, Section "Gearbox").

Remember that incomplete engagement of the speed gears or gear-shifting followed by peculiar noise (grinding) may result in chipping and rapid wear of gear teeth face. This concerns first of all the sliding straight tooth gears of the first and reverse speed gears which have no synchronizers.

For accurate and silent speed gear changing, the following requirements must be met: when changing from the lower speed gear to the higher one, use the double-clutch method, and when changing from the higher speed gear to the lower one, use the intermediate throttling method.

To use the double-clutch method, proceed as follows:

(a) after placing the vehicle in motion, increase the speed of movement;

(b) disengage the clutch and simultaneously release the accelerator pedal;

(c) set the gear-shift lever in the neutral position;

(d) release the clutch pedal;

(e) quickly depress the clutch pedal up to the stop and shift in the next higher speed gear;

(f) engage the clutch by releasing the pedal quicker than when placing the vehicle in motion, and simultaneously open up the throttle;

(g) speed up the vehicle, then shift in the next higher speed gear by using the above technique.

To use the intermediate throttling method, proceed as follows:

(a) fully depress the clutch pedal and at the same time fully release the accelerator pedal;

(b) set the gear-shift lever in the neutral position;

(c) release the clutch pedal and simultaneously depress the accelerator pedal to equalize circumferential speeds of the gears to be engaged;

(d) fully depress the clutch pedal again and simultaneously release the accelerator pedal;

(e) shift in the lower speed gear;

(f) release the clutch pedal smoothly (but quicker than when placing the vehicle in motion) and simultaneously depress the accelerator pedal so that smooth movement of the vehicle is maintained.

Diagram of the fixed positions of the gear-shift lever is given in Fig. 28.

When engaging the gearbox, transfer, water-jet propeller power take-off and auxiliary wheels power take-off, do not apply much effort to the control levers. In case these units are engaged with difficulty, release the clutch pedal and rotate the units shafts.

Run the vehicle so that its engine operates without noticeable stress, for which purpose change the speed gears in due time. The vehicle should run mainly on the fourth speed gear. If the speed is considerably decreased, driving in the fourth speed gear may cause engine overloading whose symptoms are engine vibration, knocks, and the line. In this case, it is necessary to shift in the lower speed gear. Increasing the speed of motion, shift in the higher speed gear again. Overloading is harmful to the engine and thus is intolerable.

Turning the Vehicle

When approaching a curve, gradually slow down the vehicle in advance by reducing the engine speed. Before making a sharp turn, engage the lower gear. Do not apply the brakes abruptly in sharp turns otherwise the vehicle will skid. Do not turn sharply when driving on sand, in swampy areas, or on steep upgrade or downgrade.

Braking the Vehicle

There are three methods of vehicle braking:

(a) braking with the engine: by decreasing fuel supply when driving the vehicle in a gear;

(b) braking with the service brake system: by depressing the brake pedal while the speed gear or the clutch is disengaged;

(c) combination braking: with the engine and service brake system simultaneously.

When braking the vehicle with the engine, do not switch off the ignition since fuel getting into the cylinders will wash the oil off the cylinder walls and, when penetrating into the crankcase, thin the engine oil.

Do not use the parking brake system instead of the service one as this overloads the transmission.

On a slippery road, engage the front axle and drive the vehicle at a low speed; do not change sharply the engine speed; apply the brakes smoothly and in several stages, without disengaging the clutch. The sharp braking with the disengaged clutch on the slippery road may cause skidding and results in an accident. Always attempt to brake smoothly, without jerks, avoid sliding of the wheels on the road.

Stopping the Vehicle

The vehicle is stopped as follows. When driving the vehicle on dry solid ground or hard-surface roads, stop the vehicle smoothly, for which purpose release the accelerator pedal, depress the clutch pedal, set the gear-shift lever in the neutral position, then release the clutch pedal and stop the vehicle by smoothly applying the service brake system.

If suddenly a need arises to stop the vehicle, while moving on a good dry road, do the following: release the accelerator pedal, simultaneously depress the clutch pedal and brake the vehicle sharply without making the wheels slide. After the vehicle is stopped, set the gear-shift lever in the neutral position and release the clutch pedal.

To stop the vehicle on a dirty slippery road, use the combination braking method (i.e. braking with the engine and service brake). Gradually shift in lower gears, decrease the speed to the minimum, disengage the clutch and use the service brake system to stop the vehicle. This done, set the gear-shift lever in the neutral position and release the clutch pedal.

In all cases, brake the vehicle with the parking brake system after stopping the vehicle. On upgrade or downgrade, engage in addition the first speed gear or reverse speed gear.

General Regulations for Driving the Vehicle under Various Conditions

When negotiating difficult or slippery areas, steep upgrades and natural or artificial obstacles, engage the front axle. The front axle may be engaged at halt or while moving at any speed without disengaging the clutch, provided the rear axle wheels do not slip at this moment. Continuous driving with the engaged front axle aggravates wear of transmission and tyres and increases fuel consumption. Therefore, never drive the vehicle on the hard-surface roads with the front axle engaged.

Bear in mind that higher transmission noise can be heard when driving a serviceable vehicle with the front axle engaged.

If the transfer operates in the high range, the front axle may be engaged or disengaged at any speed of movement. There is no need to depress the clutch pedal in this case. If the front axle fails to be engaged, it means that the front and rear wheels have different rolling radii due to different tyre inflation pressure or non-uniform wear.

Under heavy road conditions (swampy areas, trenches, ditches, long steep upgrades, etc.), the transfer must operate in the low range (auxiliary gearbox must be engaged).

The auxiliary gearbox should be engaged only after completely stopping the vehicle and engaging the front axle.

Under heavy road conditions, when driving the vehicle on slushy dirt roads, in swampy or sandy areas, or on virgin snow, adjust the tyre inflation pressure with respect to the strength of ground in the areas to be passed.

If the internal tyre pressure is decreased, the wheel-to-ground contact area increases, specific ground pressure decreases, and the wheels do not get deep in the mud, sand or snow, and do not slip.

Quicksand, swampy areas, slimy banks or revers and lakes, heavily soaked plows (especially in autumn and spring), and virgin snow having the covering depth exceeding 0.4 m must be negotiated at the minimum permissible tyre inflation pressure, that is, 0.7 kgf/cm^2. In exceptional cases, the tyre inflation pressure may be decreased to 0.5 kgf/cm^2. Similar areas with greater strength of ground surface layer, long steep upgrades, as well as the terrain broken by numerous natural and artificial obstacles like ditches, pits, foxholes and trenches should be negotiated with the tyre inflation pressure of 0.7 to 1.5 kgf/cm^2.

Never reduce the tyre pressure below 0.5 kgf/cm^2.

If the situation permits, after negotiating the hard terrain, stop the vehicle until the inner tyre pressure of 1.5 kgf/cm^2 is built.

Bear in mind that on slippery roads (with water-drenched carpet upon dry solid bed) the deflation of pressure in the tyres gives to positive results; on the contrary, it leads to skidding and pulling to the side of heeling. In such cases, maximum tyre inflation pressure (2.8 kgf/cm^2) must be built.

Bear also in mind that a tyre inflation pressure may go up for a short period of time at a high ambient temperature and due to long running. Therefore, do not use the air reducer to adjust the tyre inflation pressure unless there is a special necessity.

When driving the vehicle on a hard-surface road or solid ground, maintain maximum inflation pressure of 2.8 kgf/cm^2 in the tyres. The front axle should be disengaged in this case,

When driving the vehicle with the decreased tyre inflation pressure, the engine speed is limited. At a pressure of up to 0.7 kgf/cm^2 the engine speed should not ex-

ceed 10 km/h; at a pressure of 0.7 to 1.5 kgf/cm^2, 20 km/h, and at a pressure of 1.5 kgf/cm^2 to 2.8 kgf/cm^2, 30 km/h (for the period required for inflation of the tyres after negotiating difficult terrain).

Driving the Vehicle on Dirt Roads and in Marshy and Wooded Country

Clay-and-gumbo roads with soaked surface layer bear the danger of skidding and aslant slipping. Driving on slushy graded earthen roads is particularly difficult. When driving on such roads, bring the tyre inflation pressure up to 2.8 kgf/cm^2, use level portions and roadsides for riding; follow the track of a preceding vehicle or drive the vehicle carefully so that the road crown is between the wheels.

When driving the vehicle on bumpy roads, avoid great swinging of the vehicle and severe bumps of the suspension elements by decreasing the vehicle speed in due time and by smoothly crossing pits and bumps and other obstacles.

Large tracts of dense forest should be negotiated by driving the vehicle along the glades, wood roads or edges of forest.

When driving the vehicle in shrubs, reduce the speed, if possible, and carefully observe the terrain and vegetation in front, since shrubs may screen stumps, pits, pools, stones, and the like.

Stumps, hillocks and other obstacles, which in size are less than the vehicle clearance, may be passed between wheels. A track with depth equal or exceeding the clearance in size also should be passed between wheels. Obstacles equal or greater than the clearance in size should be bypassed.

When moving in the convoy in the wooded country drive the vehicle along the track of the preceding vehicles.

Swampy areas should be bypassed, whenever possible. If it is impossible to bypass a swampy area, cross it after thorough reconnaissance.

Swampy areas should be crossed in the second speed gear in the gearbox and low range in the transfer. In this case the tyre inflation pressure should be such as indicated in Subsection "General Regulations for Driving the Vehicle under Various Conditions" (see above).

When driving the vehicle in a swampy area, maintain the steady speed, avoid jerks and especially halts. If it is necessary to stop the vehicle, bring it on a hummock or on a relatively dry place.

It should be remembered that placing the vehicle back in motion after a halt in a swampy area is very difficult since a great tractive effort is required for the motion on swampy ground. This effort transmitted from wheels to ground leads to stripping of the sod layer (on upper layer of ground) and, as a result to loss of adhesion of wheels and ground, in sticking of the vehicle. Therefore to place the vehicle in motion in the swampy area, smoothly engage the clutch in order to prevent the wheels from slipping. As soon as the wheels start slipping, depress the clutch pedal and shift in the reverse gear.

If the slipping recurs in the reversing, immediately place brushwood, boards or other materials at hand under the wheels to increase adhesion of wheels with ground and make the vehicle run.

It is not advisable to make abrupt and sharp turns. Anticipate the necessity of turning and turn smoothly over a large radius. Such a turn does not reduce the speed of the vehicle and prevents possible stripping of sod inevitable in turning the vehicle sharply.

When moving in the convoy in the swampy area, each vehicle should make a new track and should not follow the track of the preceding vehicle.

If it is impossible to negotiate the swampy area under own power, use a winch, if possible.

Driving the Vehicle in Desert and Sandy Country

When driving the vehicle in the desert and sandy country, choose, if possible, areas of solid ground or with vegitation. Soaked salt-marshy, silt and clay areas, as a rule, should be bypassed or negotiated after preliminary reconnaissance.

Under conditions of dust laden air, movement in the convoy should be executed so that the driver of the following vehicle keeps the edge of the dust cloud produced by the preceding vehicles. When passing through the thick dust zone, it is necessary to avoid turns, and move in the direction chosen in good time. In this case all the members of the crew should observe the road and terrain, if possible.

Sandy areas should be also negotiated with the tyre inflation pressure reduced (from 0.7 to 1.5 kgf/cm^2).

The tyre inflation pressure should be adjusted depending upon the density of sand and conditions of driving. When negotiating dry quicksand areas with upgrades, downgrades and sand drifts, the tyre inflation pressure should be brought to its minimum permissible value of 0.7 kgf/cm^2. In negotiating the areas with average density of sand, the tyre inflation pressure must be 1 kgf/cm^2, and the areas with damp solid sand, tyre inflation pressure must be 1.5 kgf/cm^2. When moving on sand, it is more advantageous to use higher speed gears, have the front axle engaged, and negotiate sand drifts and short sand upgrades by speeding up the vehicle. In this case the speed of the motion must not exceed the permissible value for the selected tyre inflation pressure (correlation of the speed of motion and the tyre inflation pressure is given above).

When the speed of motion drops in an extremely heavy area, never let the wheels slip. In case slipping occurred, reverse the vehicle, accelerate it, and try to negotiate the obstacle by dashing. Drive the vehicle smoothly, avoid jerks and stops. Make turns smoothly over a large radius.

In contrast to driving the vehicle in swampy areas in the convoy, in sandy area the vehicle must follow the track of the preceding vehicle keeping a distance of 40 to 50 m. This distance is required for allowing the preceding vehicle to reverse and speed up in order to negotiate an obstacle by dashing.

Driving the Vehicle in Winter

After a long halt move first 400 to 500 m in the lower speed ranges in order to gradually warm solidified lubricant in the transmission and running gear units.

When driving the vehicle on virgin snow having the covering depth of 250 to 280 mm, it is not necessary to reduce the tyre inflation pressure as the wheels, pressing through the snow, roll on hard frozen soil. In case of a thick snow covering (400 mm and more), the tyre inflation pressure should be reduced to 0.7 kgf/cm^2. When driving the vehicle on deep loose snow, observe the same driving regulations as when driving on sand: negotiate snow drifts and short upgrades by speeding up the vehicle, smoothly drive the vehicle and make smooth turns, follow the track of the preceding vehicle, and maintain the distance of 40 to 50 m. If snow is deep, avoid stops and do not move along ravines and depressions.

When the vehicle gets on snow-free and ice-coated slopes, hills and the like, increase the tyre inflation pressure up to 2.8 kgf/cm^2.

If a road is slippery or ice-covered, drive the vehicle smoothly, without sharp braking and sharp turns, to avoid its skidding and slippering.

Negotiation of Natural and Artificial Obstacles

When driving the vehicle on roads and terrain with natural and artificial obstacles, the driver must be attentive and careful to the utmost degree.

As a rule, all obstacles are kept by the enemy under observation and fire. Therefore approach and leave the obstacle at the maximum possible speeds allowed by the terrain. If possible, use consealed approaches for moving to the obstacle.

Before negotiating the obstacle, leave the vehicle, if the situation permits, and attentively examine the obstacle in order to select the best place and the most advantageous method to negotiate it.

Ditches and trenches should be negotiated in the first speed gear with the front axle and auxiliary gearbox engaged and the auxiliary wheels placed into operation.

The auxiliary wheels drive should be engaged only after all the wheels are lowered in the working position. The inflation pressure in the main wheel tyres must be 1.5 kgf/cm^2 and that in the auxiliary wheels 5.5 to 6 kgf/cm^2.

Driving the Vehicle in Mountain Country

Driving the vehicle on roads and terrain with steep upgrades, downgrades and sharp turns requires particular care and quick response of the driver.

Under these conditions the following rules should be observed.

The speed gear in which the negotiation of an upgrade is possible must be shifted-in in advance, before approaching the upgrade.

In exceptional cases when the driver chose a wrong speed gear when approaching the upgrade and the vehicle speed drops abruptly due to great resistance to motion, shift in the lower speed gear in due time and quickly to prevent the vehicle from stopping and rolling backward down.

If the road permits, negotiate short upgrades by speeding up the vehicle without engaging the lower speed gear.

If possible, the upgrades should be negotiated at a right angle, in a straight way. Oblique movement that results in heeling of the vehicle sharply decreases the wheels maximum traction power which depends upon not only the engine power and transmission gear ratio but also upon adhesive weight (the weight imparted each driving wheel).

To negotiate with certainty a long steep upgrades with soft ground, it is necessary, if the situation permits, to reduce the inflation pressure in tyres to 0.7 to 1.0 kgf/cm^2.

If the vehicle power is insufficient to negotiate the upgrade, try to use the winch.

The small upgrades covered with ice and short sections of difficult terrain should be negotiated by speeding up on the preselected speed gear.

When approaching a long downgrade (longer than 50 m), estimate its steepness and shift in the required speed gear and transfer range. In negotiating such a downgrade, always use the combination braking method, i.e. braking with the engine and the service brake system. In this case do not use inertia, i.e. do not set the gear-shift lever or the transfer range lever in the neutral position.

If the vehicle on the downgrade runs with an acceleration despite the preset speed gear and, fully released accelerator pedal, and the engine starts developing a high speed, it is necessary more energetically to apply the service brake system to reduce the vehicle speed.

Never drive down the slop with the clutch disengaged and low speed gears engaged as this may cause impermissible increase of revolutions of the clutch driven disc and, as a result, to tearout of the driven disc friction facings due to centrifugal forces.

While driving the vehicle on mountain roads it is necessary to keep very close to the side opposite to a precipice and attentively watch the movement of the preceding vehicle.

During negotiation of steep and slippery upgrades (downgrades) the following vehicle should not start negotiating the upgrade (downgrade) until the preceding vehicle has negotiated it. If the vehicle while negotiating the upgrade has started slipping down and the braking does not make the vehicle stop, in case emergency it is necessary to direct the vehicle (avoiding speeding-up) towards a jut of a cliff or other ground feature which can stop the vehicle.

On sharp turns (especially on serpentines) in case of failure to turn the vehicle in one motion, turn the vehicle alternately by the backward and forward running on the order to the vehicle commander (senior).

On road sections with closed turns, defiles or landslides as well as in other areas dangerous for movement the commander (senior) of the vehicle must control the driving. In this case the commander should move ahead of the vehicle.

When driving the vehicle in mountain out of roads, it is necessary to chose a direction with the least angles of ascent (descent, heeling) and the smallest quantity of stones. If it is impossible to bypass some stones, negotiate them by the wheels of one side and direct the wheels of the other side to the free portion of the way. Evade shocks of the vehicle bottom against stones and stumps to avoid damage to the bottom.

When driving the vehicle on shallow snow, on upgrades, downgrades, slopes, it is preferable to choose areas covered with tiny vegetation, when driving on soaked ground, choose rocky areas.

Prior to negotiating areas with landslides and screens, reconnoitre them, evaluate possibility of driving the vehicles and clear them, if necessary.

Pay particular attention to the engine temperature mode of operation preventing it from overheating.

To stop the vehicle, choose safe places, if possible, with least angles of ascent (descent, heeling) and with solid ground. In case of stopping on the upgrade (downgrade), brake the vehicle with the aid of the parking brake system, shift in the first speed gear or reverse speed gear, and place stones or a log. Do not stop the vehicle near the defiles, on narrow roads, at sharp turns and at places of probable avalanche.

Driving the Vehicle Equipped with Night Vision Devices

The night vision devices make it possible to drive the vehicle at night at a speed that depends on the given road and terrain conditions.

An image of the terrain and objects within the device field of view differs in colour from that usually perceived by eye since the image in the device screen is single-colour (green) but of variable brightness. Therefore, the user must acquire certain skill in recognizing the objects in the device screen. When driving at night with the use of night vision devices, the vehicle speed is lower than under similar conditions in the day time and depends to a great extent on the driver's skill.

When driving the vehicle in an area where spotlights and flares are used, when an oncoming vehicle with the headlight glare on is approaching or when an intensive light source suddenly appears not far from the vehicle, set blinds of vision devices TBHO-2B and TKH-1C in position 3AKP. (CLSD). For better observation of the road, switch off or, if possible, decrease lighting of the driving compartment.

In case observation with vision device TBHO-2B is impeded due to ambient subzero temperature, turn on the device electric heater to protect the outer surfaces of the device optical elements from sweating and covering with hoar frost. Device TBHO-2B and two devices THHO-11B are switched on simultaneously with the switch mounted on temperature regulator PTC-27-3A (see Chapter 10 "Vision Devices").

OPERATION ON WATER

The vehicle is capable of entering water without a stop, floating and negotiating shallows and bars.

Successful crossing of a water obstacle greatly depends upon the condition of the bank where the vehicle goes into and out of the water. Whenever possible, a hard ground sloping bank free of silt, algae and large protruding obstacles like stumps, stones, boulders, and the like, must be chosen for entering the water.

In case crossing of body of water is anticipated, proceed as follows:

1. Check that the plugs in the vehicle hull bottom are tightened and that the kingston valve and valves of water discharge system are closed.

2. Open the by-pass valve of the water drainage system if there is no need to build up overpressure in the habitable compartments.

3. With the engine running, check the water-jet propeller and its drive for proper engagement and operation.

4. Check the rubber seals on the auxiliary wheel hydraulic hoists and the transfer case seals at the entry of the propeller shafts for condition. The transfer case seals should be checked from under the vehicle hull, through the floor hatch.

Before long operation on water, remove the floor panel over the transfer case and see that the seals are in good condition and properly tightened.

5. Put on the life jackets.

6. In beaching, adjust the tyre inflation pressure for 0.7 to 1 kgf/cm^2 near the water's edge.

When it is necessary to perform hasty crossing of a water obstacle, start to decrease the tyre pressure at a distance of 1000 to 1500 m from the obstacle until the pointer of the air reducer gauge indicates 0.7 to 1 kgf/cm^2.

Before entering the water, do the following:

1. Close the air inlet and outlet doors.

2. Raise the splash panel and open the water-jet propeller shutter.

Depending upon the condition of the bank and soil, presence of shallow water near the bank and flatness of the slope, enter the water with the first or second speed gear and the front axle engaged in the transfer low range, at a speed of 5 to 10 km/h and preferably at a right angle to the water's edge.

As soon as the vehicle is afloat, depress the clutch pedal and set the gear shift lever in the neutral position, thus disengaging the driving axles, and then turn in the water-jet propeller. With considerable flow velocity of a water obstacle, the water-jet propeller should be turned on just before entering the water.

Right after entering the water, make sure that there is no leakage. If a substantial leakage is detected, i.e. if the capacity of the bilge pump is lower than the rate of water inleakage caused by combat damage to the hull, immediately beach the vehicle.

If the depth is small and the vehicle wheels contact the bottom, engage the first or second speed gear in addition to the water-jet propeller. In all cases the front axle and the transfer low range gear should remain engaged until the vehicle comes on the land.

When the depth of a water obstacle is sufficient, only the water-jet propeller must operate.

In exceptional cases when the linkage of the water-jet propeller shutter or the water-jet propeller is defective, the motion may be continued due to operation of the main wheels. This is attained by engaging the second speed gear and the front axle, or by engaging the third speed gear and the transfer low range gear. The speed of motion in this case should be about 4 km/h.

When the vehicle is propelled on water only by the wheels, carefully monitor the engine operating temperature since the heat exchanger operating efficiency considerably decreases if the water-jet propeller is inoperative.

To avoid overheating of the transmission as well as premature wear of the transmission and engine, do not operate the engine throttled-wide for more than 15 min within each hour of operation on water.

Remember that during operation on water, the engine fuel consumption at a cruising speed is half as much as that at a maximum speed although the difference in speed of the vehicle on water is insignificant (about 1 km/h). Therefore, it is expedient to drive the vehicle forward or reverse only at a medium speed of the engine.

If the vehicle operates in surf, maintain the vehicle headway into the seas. When encountering a large frontal wave, slow down the vehicle to cushion the shock.

Certain peculiarities of the vehicle turning on water should be taken into account, including the delay in turning of the vehicle. To stop the vehicle on water quickly, engage the water-jet propeller in reverse.

To reverse the vehicle, proceed as follows.

1. Release the accelerator pedal.

2. Depress the clutch pedal.

3. Engage the reverse gear of the water jet propeller power take-off.

4. Engage the clutch.

5. Adjust the engine for a medium speed.

If the body of water is covered with algae, scum or floating ice, the grill of the water-jet propeller intake branch pipe located in the hull bottom may become clogged. This will result in the drop of speed and even to stopping of the vehicle.

To flush the grill, engage the reverse gear of the water-jet propeller power take-off and operate the engine for 1 or 2 min at a medium speed. When moving in an overgrown body of water, find the free water to move in, and engage the water-jet propeller only after the vehicle entered the water.

To avoid clogging of the water-jet propeller and winding of algae on the propeller screw, it is advisable in some cases to move in the overgrown body of water without engaging the water-jet propeller but by applying the above method of using the wheels only.

During operation on water, the crew must evacuate water out of the hull in due time using the drainage valve of the water discharge system for the purpose.

After water is evacuated from the vehicle hull, immediately close the drainage valve. Otherwise, air sucked in the valve will greatly impair the operation of the water-jet propeller, and with the water-jet propeller inoperative and the valve opened, the vehicle hull will quickly become full of water.

During operation on water the vehicle may run aground so that its bottom will rest on the shoal and its wheels may stick so that the water-jet propeller will be unable to move the vehicle off the shoal. In this case, engage the driving axles. If this does not help, try to swing the vehicle to-and-fro by engaging alternately the forward and reverse speed gears in the gearbox and in the water-jet propeller power take-off. Keep on swinging the vehicle until it starts sliding off the shoal. When negotiating fast-running shallow water (rapids), stay away from large boulders as the vehicle is subject to long drift caused by the stream and the one-side impact of the wheels against an underwater obstacle may cause deep heeling and even capsizing of the vehicle.

Coming on the land. When selecting a place for coming on the land, a steep bank with hard ground should be preferred to a sloping band with swampy or silt ground.

Prior to getting on the land, accelerate the vehicle to the maximum speed and, when approaching the shore, engage the first speed gear in the gearbox.

Steer the vehicle perpendicular to the shore line to minimize the possibility of sudden heeling and slipping of wheels. Do not stop the vehicle until all the wheels are on the hard ground unless there is a pressing necessity, or the vehicle may get stuck.

If when ascending a steep bank the wheels start slipping, do not let them stick but immediately engage the reverse speed gear and reverse the vehicle along its track into the deep water, and then chose a new place for going from water to land.

In case of unsuccessful attempt to ascend a steep bank, reverse the vehicle slowly, or otherwise rolling of the vehicle into the water, particularly into the deep water, may result in flushing of much water into the vehicle hull.

If the vehicle cannot get onto the bank by its own power, use the winch for self-recovery. For this done, find a tree, stump or other object at a distance of 10 to 15 m from the water's edge, preferably in the direction of getting onto the bank (if possible, do this in advance, when the vehicle is still on water), and attach the winch wire rope to this object. Instructions on operation of the winch are given in Chapter 11 (Section "Winch").

When on land, disengage the water-jet propeller drive (do not care to depress the clutch pedal in this case), close the water-jet propeller shutter, lower the splash panel and then set the handle of the shutter control cock in the RUDDER (РУЛЬ) position and open the air inlet and outlet doors.

If possible, stop the vehicle on a level ground, and drain water from the hull through the water drain valves. Inspect the hull, bottom, wheels, steering gear and suspension.

If the situation does not permit stopping of the vehicle immediately after coming out of the water, drain water from the hull in motion, and perform the inspection of the vehicle at the very first halt.

TOWING THE VEHICLE

For towing a disabled vehicle on land, two towing hooks are welded to the armour plates of the vehicle hull front lower portion, and others, at the rear from below. One end of the towing rope is secured on the front hook and the other, in the clamps located along the right side of the vehicle hull.

To tow vehicle БРДМ-2 with the vehicle of the similar type, use should be made of two towing ropes 1 (Fig. 159, A) of the two vehicles. The ropes are coupled by means of coupler 2 available in the vehicle SPTA set.

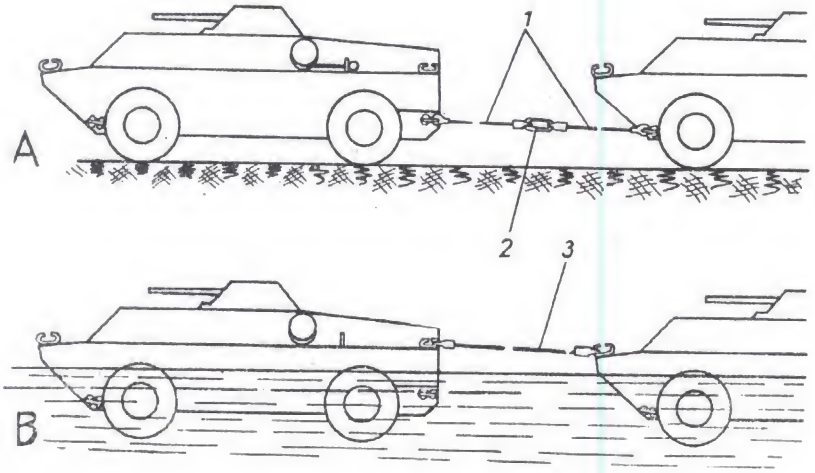


FIG. 159. TOWING THE VEHICLE

1 – towing ropes; 2 – coupler; 3 – special wire rope for towing vehicle on water; A – towing vehicle on land; B – towing vehicle on water

For towing a similar vehicle on water, the deck plates are fitted with special staples. Two staples are located at the rear and one more at the front of the vehicle hull. It is not allowed, anyhow, to attach the wire ropes to these staples for towing the vehicle on land.

Towing of the vehicle on water is accomplished with the aid of a special rope wound on a drum located on the left-side plate of the vehicle hull.

For towing the vehicle on water, lower the splash panel of the vehicle to be towed, remove the wire rope from the drum and secure one end of the rope in the staple, on the vehicle hull front plate and the other, to one of the staples at the rear of the towing vehicle (Fig. 159, B).

In case the splash panel fails to go down or in case of waves, the towing can be effected with the towing rope intended for towing the vehicle on land.

To use the towing rope, proceed as follows:

(a) release one end of the towing rope of the vehicle to be towed from the clamps and connect it to the wire rope intended for towing the vehicle on water by making use of the coupler;

(b) secure the free end of the wire rope used for towing the vehicle on water in the staple on the rear plate of the towing vehicle.

When towing the vehicle, be particularly careful and observe the following regulations:

1. Start towing (reduce slackening of the towing wire rope) at a low speed until the towing rope is straightened. Only when the towing rope acquires the needed tension, it is allowed to speed up, although the engine is not allowed to operate throttled-wide. The increase of the engine speed from medium to maximum offers an insignificant gain in the speed of towing and may result in sharp increase of fuel consumption, overloading of the water-jet propeller drive parts and flooding of the front part of the towed vehicle.

2. Bear in mind that maneuverability of the towing vehicle on water is limited as, since the rope is attached to one of the staples made at the rear along the sides, the towing vehicle loses its ability to turn to the side opposite to the point of the wire rope attachment in the rear. If there is an urgent need to make such a turn, loose the towing rope and rehook its end to the other staple in the rear of the towing vehicle.

3. The vehicle must move as smoothly as possible, without abrupt change in the taken course, particularly when passing over bars or running downstream. In such cases, yawing of the vehicle may lead to striking by the towed vehicle against local objects or the bank or to running aground.

4. Do not abruptly change the speed of the towing vehicle and never bring it to a sudden halt. This may cause collision of both vehicles.

5. Take particular care when passing-by any oncoming ship.

6. Reduce the speed of motion to a minimum in mooring or beaching of the towed vehicle.

7. Never stay on the roof of the vehicle.

The crew of the towing vehicle should carefully watch the towed vehicle. The crew of both vehicles should communicate with simple and clear visual or other signals.

WARNING. Towing of the vehicle of the same type on water in the said way using the vehicle organic facilities is allowed in water obstacles up to 10 m deep. In deeper bodies of water the vehicle should be towed only with the wire rope whose length ensures survival of the towing vehicle in case the towed (disables) vehicle is sunk.

For pulling the towed vehicle onto the bank after its wheels contact the ground, reset the towing rope in the position for towing the vehicle on land, otherwise breakage of the device used for towing the vehicle on water may occur.

After going out of the water, wind the special wire rope on the drum and secure it with the clamps.

Chapter 17

MAINTENANCE OF VEHICLE

All maintenance operations on the vehicle set forth in the present Instructions must be carried out after a specified run irrespective of operating conditions and season.

The types of the vehicle maintenance are the following:

(a) Routine Inspection (to be carried out before operation and at halts);

(b) Daily Maintenance;

(c) Preventive Maintenance No. 1 (to be carried out every 1000 km of run);

(d) Preventive Maintenance No. 2 (to be carried out every 3000 km of run);

(e) Seasonal Maintenance (to be carried out in spring and autumn).

The purpose of maintenance services is checking the vehicle for serviceability and preparing it for further operation.

The driver's tool kit and the on-vehicle SPTA set are used for maintenance operations depending upon the defects revealed during inspection.

The vehicle should be lubricated according to the Maintenance Instructions and Lubrication Chart.

In the process of maintenance, never wipe the vehicle units with gasoline or wash the electrical equipment with water.

ROUTINE INSPECTION

The routine inspection should be carried out before operation and at short halts in march.

Operations	Materials
1. Check fuel, lubricating and cooling systems for proper filling. Replenish, if necessary 2. Make sure there is no leakage in fuel, lubricating and cooling systems	Gasoline A-76*; oil AC-8; water or antifreeze

* See foot-note, page 14.

Continued

Operations	Materials
3. Start the engine and check its operation under different operating conditions. Check the instruments for proper functioning 4. Check lighting and warning devices for functioning. 5. When stream-crossing is expected, check to see that plugs in hull bottom are screwed in and make sure that rubber seals of transfer and auxiliary wheel hydraulic hoists are in good condition. Clean intake screen of bilge pump and water discharge system valves 6. Check turret mount mechanisms for condition, ammunition boxes for reliable attachment and the machine guns for fire readiness (to be checked by gunner) 7. Check radio station, navigational equipment and roentgenometer for proper operation (to be checked by vehicle commander or radio operator) 8. Check tyre inflation pressure and adjust it as required by road conditions 9. Make sure there is no leakage in pipes and joints of brake hydraulic control. Check service and parking brake systems for proper functioning	

DAILY MAINTENANCE

Daily maintenance is carried out after eacn operation of the vehicle irrespective of the kilometrage covered.

Operations	Materials
1. Check fuel, lubricating and cooling systems for proper filling. Replenish, if necessary	Gasoline A-76*; oil AC-8; water or antifreeze
2. Clean the vehicle on the outside and inside of dirt and dust (of snow in winter) and wash it on the outside.** Clean water-jet propeller of dirt and check whether shutter opens freely In winter, clean recess of steering gear pendulum lever, outer hoses and chains of ice and dirt	
<u>Armament and Vision Aids</u>	
1. Check for dust in machine gun barrel bores, on their movable parts and on sight. Lubricate barrel bores, if necessary	Liquid gun grease

* See foot-note, page 14.

** When using washing machine (type MM-800 or other), never direct the water jet at a pressure exceeding 0.7 kgf/cm^2 right on the vision devices, head lamps, side lamps or tail lights to avoid damage.

Continued

Operations	Materials
After firing, clean and lubricate machine guns КПВТ and ПКТ according to instructions in their handling memos. 2. Check the machine gun mount elevating and traversing mechanisms, stops and brakes for operation. 3. Check electric triggers circuit for continuity and electric triggers for proper functioning 4. Check cable retracting mechanism of machine gun КПВТ for condition by cocking and triggering. 5. Check empty case-and-link ejection chutes for condition. 6. Check ammunition belts for proper loading and, if necessary, align cartridges in the belts. 7. Clean vision devices of dust and dirt. In doing this, follow directions set forth in Chapter 10, "Vision Devices". To avoid freezing of vision devices ТНП-Б, ТНПО-115 and ТВНО-2Б to their seats after being exposed to rain or after operation on water in autumn and spring at subzero temperatures, remove devices from their seats, wipe them dry, coat with thin film of lubricant ЦИАТИМ-201, and reinstall (see that lubricant does not get on rubber seals).	
Power Plant	
1. Check fuel, lubricating and cooling systems for leakage. Eliminate, if any 2. After driving on dusty roads, clean and wash carburettor air cleaner and change oil in it. 3. Check air cleaner-to-carburettor joint for tightness. 4. Check belts of water pump, fans, compressor and generator for proper tension. Adjust, if necessary 5. Start engine and listen to its operation. In case of bad starting, perform trouble-shooting. In case of valve knocking with engine heated, adjust valves.	Engine oil (used oil must be settled)
Transmission	
1. Check gearbox, transfer, water-jet propeller housing, axle housings and other units for oil leakage. Make sure there is no leakage in clutch control hydraulic system and pipes of auxiliary wheels 2. Check that there is no oil on vehicle hull bottom. If there is, perform trouble-shooting. 3. Check rubber protective covers on auxiliary wheels hydraulic hoists and transfer	

Continued

Operations	Materials
Running Gear	
1. Examine tyres and external hoses 2. Check visually drive chains of auxiliary wheels. Make sure they are free of foreign objects. Remove foreign objects that got into chain links or between sprocket teeth and chains	
Control Mechanisms	
1. Check steering wheel for free travel and steering gear external parts for condition 2. Check service and parking brake systems for good functioning and adjust them, if necessary. Make sure that pipes and connections of brake hydraulic control are not leaky	
Electrical Equipment	
1. Check storage battery for reliable attachment and clean it of dust and dirt 2. Clean headlights, side lamps and tail lights of dirt and dust, wipe them with clean waste and check for reliable attachment 3. When starting engine, check all test and measuring instruments for serviceability and generator regulator for proper functioning in compliance with the instructions given on pages 132 and 133 4. Check lighting and signalling devices (headlights, lights, dome lights, turn indicators, stop light, blackout mode switch) for proper operation. 5. Check and, if necessary, adjust tension of belts of generator drive[x)]	
Other Equipment	
1. Check entrenching tools, accessories, and other standard equipment for completeness, serviceable condition and reliable attachment. 2. Clean intake pipe screen of bilge pump and water discharge system valves 3. Drain condensate from air cylinders of tyre pressure control system. 4. Check radio station, navigational equipment and roentgenometer for proper operation (to be checked by vehicle's commander or radio operator). In case of operation on water, perform also the following: 1. Make certain that there is no water in cavities of brake drums. 2. Make sure there is no water in driving axle housings and steering knuckles. In case water is found, lubricate anew and eliminate cause of trouble that resulted in inleakage.	

x) This operation should be performed during Daily Maintenance in the course of first 1000 km of run, further on, during Preventive Maintenance No. 1.

Continued

Operations	Materials
3. Remove glass from side lamps, clean inner surface of side lamps and wipe them dry	
4. Lubricate the following parts:	
(a) chains of auxiliary wheels drive;	Used engine oil
(b) towing ropes;	Same
(c) auxiliary wheels rocking shafts (2 lubrication points);	Solid oil C, lubricant УС or ЦИАТИМ-201
(d) hinges of steering gear connecting rod (2 lubrication points);	Solid oil C or lubricant УС
(e) hinges of steering tie rod (2 lubrication points)	Same
After 25 hours of operation on water, do the following in addition to said above:	
Check level of oil in water-jet propeller reduction unit housing and replenish it, if necessary	Oil МТ-16п
After 50 hours of operation on water:	
(a) change oil in water-jet propeller reduction unit housing;	Oil МТ-16п
(b) lubricate water-jet propeller shaft universal joints (2 lubrication points)	Lubricant No. 158 or lubricant ЦИАТИМ-201

PREVENTIVE MAINTENANCE No. 1

Preventive Maintenance No. 1 is carried out every 1000 km of run.

Operations	Materials
Perform all operations of the daily maintenance and, additionally, do the following:	
Power Plant	
1. After the first 1000 km of run, check cylinder head stud nuts for proper tightening (on cold engine). Repeat this operation during Preventive Maintenance No. 2 (after 3000 km of run) and further on every other Preventive Maintenance No. 2	
2. Clean carburettor air cleaner and fill it with fresh oil	Engine oil (used oil must be settled)
3. Check carburettor for attachment to engine intake manifold	
4. Check exhaust manifolds, clutch housing and starter for reliable attachment (only after the first 1000 km of run)	
5. Lubricate sending unit of pneumatic centrifugal speed governor	Oil AC-8
6. Operate grease gun to lubricate:	
(a) bearings of axles of fans (2 lubrication points);	Fat lubricant 1-13
(b) bearings of water pump (1 lubrication point)	Lubricant Lithol-24

Operations	Materials
Transmission	
1. After the first 1000 km of run, check bolts and nuts of all propeller shaft flanges for tightening and tighten them up, if necessary. Further perform this operation during Preventive Maintenance No. 1 on intermediate shaft and during Preventive Maintenance No. 2 on all other shafts 2. Check pusher of clutch control operating cylinder for travel (which must be 20 to 22 mm) and bleed air from hydraulic system, if necessary 3. Check gear-shift linkage and interlocking mechanism for proper adjustment 4. Check axle drive reduction unit cases for proper attachment to axle housings. Tighten up bolts, if necessary (do this only after first 1000 km of run)	
Running Gear	
1. After the first 1000 km of run, check axle shaft flange nuts for tightening, and tighten them up, if necessary. Further, perform this operation during Preventive Maintenance No. 2 2. After the first 1000 km of run, check nuts of spring U-bolts for proper tightening, and tighten them up, if required. Further perform this operation during Preventive Maintenance No. 2 3. After the first 1000 km of run, check nuts securing front axle spherical bearings to axle shaft housings for proper tightening*. Further, perform this check every 6000 km of run 4. Visually check springs, shock absorbers and their holding parts for condition. 5. Check wheel nuts for tightening, and tighten them up, if necessary 6. Check inflation pressure in auxiliary wheel tyres and bring it to normal value, if required	
Control Mechanisms	
1. After the first 1000 km of run, check steering knuckle lever for proper attachment, and tighten up nuts, if necessary. Further, perform this operation during Preventive Maintenance No. 2 2. After the first 1000 km of run, check brake drums for proper attachment to wheel hubs, and tighten up bolts, if required.	

* Perform this check with front axle jacked up.

Continued

Operations	Materials
Further perform this operation during Preventive Maintenance No. 2	
3. After the first 1000 km of run, check steering gear for proper attachment. Tighten up fastening parts, if required. Further perform this operation during every Preventive Maintenance No. 2	
4. Force lubricant into the following parts until lubricant shows up:	
(a) joints of steering tie rod (2 lubrication points);	Solid oil C or lubricant УС
(b) joints of steering gear connecting rod (2 lubrication points)	
Electrical Equipment	
1. Check and, if necessary, adjust tension of generator drive belts	
2. Check level of electrolyte in storage battery*	
3. Check wire lugs for reliable fastening on battery terminals	
4. Check ignition system wires for reliable connection	
5. Check all contacts of wiring for condition and all connectors for cottering. If cotter pin is missing, tighten nut of connector and lock it with wire	
6. Check position of covers, inserts and doors of blackout devices	
Other Equipment	
1. Lubricate the following parts:	
(a) hinges of vehicle hull hatch doors;	Used engine oil
(b) wing nuts securing entrenching tools, towing rope, and so on;	Solid oil C or lubricant УС
(c) axles of latches of front and rear towing hooks	Used engine oil
2. Check level of fluid in hydraulic system tank, and replenish, if necessary	Oil АМГ-10

PREVENTIVE MAINTENANCE No. 2

This must be carried out every 3000 km of run.

* In hot season, check the level of the electrolyte every 5 or 6 days

Continued

Operations	Materials	Notes
Perform all operations of Preventive Maintenance No. 1 and, in addition, do the following:		
Armament		
1. Check sealing of turret shield, turret race, elevating and traversing mechanisms of turret mount for attachment		Every 6000 km of run
2. Check machine guns and sight for proper attachment		
Power Plant		
1. Check cylinder head stud nuts (on cold engine) for proper tightening		First time after 1000 km, then after 3000 km, and further on, every 6000 km of run
2. Change oil in engine crankcase. Wash and then oil packing of crankcase ventilation filter. Disassemble and clean centrifugal oil cleaner of sediment and dirt	Oil AC-8	
3. Check intake manifold for attachment and tighten nuts, if necessary		Every 6000 km of run
4. Check engine for attachment to frame and rubber pads for condition		Every 6000 km of run
5. Blow through carburettor air and fuel idle jets with compressed air		Every 6000 km of run
6. Wash fine fuel filter with gasoline and blow it through with compressed air		Every 6000 km of run
7. Drain water and dirt from gravitation fuel filter		
8. Wash filter element of gravitation fuel filter		Every 6000 km of run
9. Inspect radiator expansion tank cap and check cap valves for proper functioning and the gaskets for condition by pressing them with a finger		
10. Add lubricant into the bearings of water pump drive belt tension roller	Lubricant LITHOL-24	Every 6000 km of run
11. Check flanges and gaskets of exhaust manifolds for blow-by, and tighten nuts, if necessary		
12. Check radiators for attachment and clean them on the outside, if necessary		

Continued

Operations	Materials	Notes
Transmission		
1. Check bolts and nuts that secure flanges of all propeller shafts for tightening and, if necessary, tighten them as far as they will go.		
2. Check the bolts securing the bearing caps of the transmission units for proper tightening		Every 6000 km of run
3. Check gearbox for reliable attachment to clutch housing, and power take-off, to gearbox casing		Every 6000 km of run
4. Change lubricant in splined joints of the front and rear propeller shafts (2 lubrication points)	Lubricant YC or solid oil C	Every 6000 km of run
5. Lubricate bearings of gearbox control linkage shaft (2 lubrication points) and slide surfaces of interlocking mechanism linkage (5 lubrication points)	Solid oil C or lubricant YC	Every 6000 km of run
6. Check oil level in axle drive housing of front and rear axles. If necessary, replenish	Oil used in hypoid gears of trucks	Change oil every 6000 km of run
7. Check oil level and, if necessary, replenish oil in the following units:		
(a) in gear case and in water-jet power take-off gear casing;	Oil MT-16n	Change oil every 6000 km of run
(b) in reduction unit housing, transfer case and auxiliary wheels power take-off casing (2 lubrication points)	Oil MT-16n	Change oil every 6000 km of run
8. Check level of operating fluid in master cylinders of clutch control		
Water-Jet Propeller		
1. Visually check propeller screw blades for condition and propeller screw for attachment on shaft. If dents, bending of blades and run-out of propeller screw are detected, eliminate defects*		
2. Check nuts of flanges of water-jet drive propeller shafts for reliable tightening. Water-jet propeller shaft should rotate easily when a hand effort is applied to flange. If not, perform trouble-shooting.		

* Propeller screw must be reconditioned in repair shop.

Operations	Materials	Notes
3. Force lubricant into shaft of water-jet propeller shutter until fresh lubricant comes off joints	Fat lubricant 1-13	Every 6000 km of run
Running Gear		
1. In case auxiliary wheels were used in an operation, check nuts of propeller shaft flanges of auxiliary wheels drive for tightening, and tighten up, if required		Every 6000 km of run
2. Check nuts of spring U-bolts for proper tightening, and tighten them up, if necessary		
3. Check bearings of steering knuckle king pins for proper tightening, and adjust, if necessary		Every 6000 km of run
4. Lubricate upper king pin bearings (2 lubrication points, 15 to 20 g for each)	Lubricant YC or solid oil C	Every 6000 km of run
5. Check nuts that secure front axle spherical bearings to axle shaft housings* for tightening		Every 6000 km of run
6. Check end play of hub bearings by swinging the wheel. If necessary, adjust bearings		Every 6000 km of run
7. Check tightening of nuts securing axle shafts, and tighten up, if required		Every 6000 km of run
8. Check toe-in		Every 6000 km of run
9. Lubricate auxiliary wheel rocking shafts (2 lubrication points)	Solid oil C or lubricant YC	Every 6000 km of run
10. Add 100 g of lubricant into each knuckle joint (2 lubrication points) through lubrication fittings	Mixture of lubricant YC (70 per cent) and oil MT-16n (30 per cent). Mix lubricants without heating or long-stapled lubricant AM (for propeller shafts)	Every 6000 km of run

* Checking should be performed upon jacking up the front axle.

Continued

Operations	Materials	Notes
Control Mechanisms		
1. Open access doors of brake drums. If lubricant is detected in them, remove drums and wash friction facings and drums with gasoline. Find cause of oil inleakage into drums and eliminate it		
2. Remove the brake drums jointly with axle shafts and driving flanges, remove dust from facings and add lubricant from outer side of oil seal unit of tyre pressure control system (4 lubrication points)	Lubricant ЦИАТИМ-201	Every 6000 km of run
3. Check brake drums for reliable attachment to wheel hubs. Tighten up bolts, if necessary		
4. Check steering gear for attachment. Make sure there is no oil leakage from housing. If necessary, eliminate leakage cause, tighten up fastening parts and replenish oil in housing	Oil МТ-16п	
5. Check and, if necessary, adjust backlash of steering worm and gear		Every 6000 km of run
6, Check steering gear hydraulic booster cylinder and steering column for attachment		Every 6000 km of run
7. Check attachment of steering arm, pendulum lever and its bracket.		
8. Check steering knuckle lever for proper attachment		
9. Check brake valve for tightness		Every 6000 km of run
10. Lubricate hinged joints of steering arm (2 points)	Solid oil C or lubricant УС	Every 6000 km of run
11. Lubricate friction surfaces of rudder control hinged joints	Lubricant АМС-3	Every 6000 km of run
12. Check level of braking fluid in hydraulic brake master cylinder If required, replenish	Oil АМГ-10	
13. Check and, if necessary, adjust transfer and water-jet propeller power take-off controls		Every 6000 km of run.
Electrical Equipment		
1. Remove starter and check it for operation according to instructions given on pages 133 and 134.		Every 6000 km of run and at least once a year
2. Check tightening of wire lugs on starter and generator terminals; check sheathing fastening nuts for proper tightening		

Operations	Materials	Notes
3. Remove distributor cap (without disconnecting wires) and thoroughly wipe it with cloth soaked in clean gasoline. Examine distributor cap and rotor		
4. Examine breaker points. Use feeler gauge to check gap between points. If necessary, clean points and adjust gap. Check distributor body for proper attachment		Every 6000 km of run
5. Examine generator and generator regulator. If necessary, perform operations as set forth on page 134.		
6. Use cloth to wipe surface of ignition coil and ignition wires. If indications of overheating or dripping of filler are detected on coil surface, replace it. Replace ignition wire if its insulation is damaged.		Every 6000 km of run
7. Lubricate distributor. To do this proceed as follows:		
(a) give grease cup cover one revolution	Lubricant ЦИАТИМ-201	Every 6000 km of run
(b) put one drop of oil into breaker lever axle;	Oil AC-8	Every 6000 km of run
(c) put 4 or 5 drops of oil into breaker cam bushing;	Oil AC-8	Every 6000 km of run
(d) put 1 or 2 drops of oil on wick oiler of breaker cam	Oil AC-8	Every 6000 km of run
8. If adjustment of breaker point gap has been performed, check spark timing and hear how engine operates after placing vehicle in motion		
9. Remove spark plugs, examine insulator surface, check gap between electrodes. If necessary, adjust gap and remove dirt from insulator surfaces		Every 6000 km of run
10. Determine battery state of charge by specific gravity of electrolyte. In case of discharge above permissible value, remove storage battery from vehicle and send it for recharging		
11. Lubricate hinged joints of windshield wiper control	Lubricant ЦИАТИМ-201	Every 6000 km of run
12. Lubricate air inlet and outlet doors electric control elements:		
(a) electric control friction surfaces;	Lubricant ЦИАТИМ-201	Every 6000 km of run

Continued

Operations	Materials	Notes
(b) limit switch stems	Fat grease 1-13	Every 6000 km of run
Other Equipment		
1. Check excessive pressure in habitable compartments of vehicle		Every 6000 km of run
2. Check jack for proper functioning. If required, add fluid and eliminate revealed defects	Instrument oil МВП or oil АМГ-10	Every 6000 km of run
3. Check tightening of nuts that secure hydraulic system pump		Every 6000 km of run
4. Turn hydraulic system filter handle through 25 to 30 clicks		Every 6000 km of run
5. Lubricate the following parts:		
(a) winch shaft and drum bearing;	Solid oil С or lubricant УС	Every 6000 km of run
(b) splines of winch drum sliding coupling	Used engine oil	Every 6000 km of run
6. Clean of dirt and lubricate towing ropes and winch cable	Used engine oil	Every 6000 km of run
7. Change oil in winch case	Oil МТ-16п	Every 6000 km of run

SEASONAL MAINTENANCE

The seasonal maintenance operations are performed in spring and autumn jointly with the scheduled maintenance operations. The seasonal maintenance includes the following operations to be performed.

In Autumn

1. Clean the heating system cocks and check the pipelines for condition.
2. If the cooling system was filled with water without three-component additive, flush the cooling system to remove scale and sediments and fill it with antifreeze.
3. Drain sediment from the fuel tanks, Wash the fuel tank sections. Wash the gravitation fuel filter and the fine fuel filter.
4. Perform operations pertaining in care of the starting preheater specified in Section "Care of Starting Preheater", page 232.
5. Carry out the operations pertaining to care of carburettor, (see Section "Care of Fuel System", page 47.
6. Lubricate choke and throttle control rods.
7. Check that oil is delivered to the rocker shafts (see Chapter 2, Section "Lubricating System").
8. Lubricate bushings of windshield wiper lever shafts with lubricant ЦИАТИМ-201 through the lubrication fittings.
9. In case of the vehicle heavy-duty operation (stream-crossing or fording), check splined connections of front and rear axles propeller shafts for presence of water, If any, replace lubricant.

10. Check the sight desiccator for condition. If silica gel is pink, replace the desiccator capsule.

11. Switch on the motors of the heater, windshield defroster and starting preheater blower for 15 to 20 min and the motors of the windshield wiper, filter-ventilator unit, special blower and electric bilge pump for 5 to 7 min.

In Spring

1. Drain antifreeze into a vessel and fill the cooling system with clean water adding three-component additive.

2. Check that lubricant is supplied to the rocker shafts (see Chapter 2, Section "Lubricating System").

3. Lubricate bushings of windshield wiper lever shafts with lubricant ЦИАТИМ-201 through the lubrication fittings.

4. Check the sight desiccator for condition. If silica gel is pink, replace the desiccator capsule.

STORAGE

Every БРДМ-2 vehicle which is expected to be out of operation during a period of more than a month is subject to placing in storage.

To prepare the БРДМ-2 vehicle for storage after operation on sea water (even for a short period of time), do the following:

(a) drain remaining salt water from the vehicle hull;

(b) wash the outer surfaces of the vehicle parts with fresh water; pay particular attention to the areas directly affected by salt water;

(c) blow with compressed air, wipe with waste and dry the washed surfaces of the vehicle parts;

(d) recondition defective paint coatings;

(e) lubricate non-painted metal surfaces with engine oil;

(f) lubricate all the hinged joints and add lubricant at all lubrication points;

(g) in case the vehicle is being prepared for storage and oil in its units is not replaced, check oil in the engine lubricating system, gearbox, transfer, axles, water-jet and winch housings for presence of water. For this purpose, take samples (0.5ℓ) of sediment from each unit. Heat samples of oil in a test tube on open fire. If water is found (oil crackles), start the engine and operate for 15 to 20 minutes, while alternately engaging all speed gears and units, then drain oil from them and pour in fresh oil;

(h) remove the electric bilge pump and clean the impeller of salt deposit and corrosion products, then reinstall the pump and check it for operation.

LUBRICATION

All data pertaining to the grades of lubricants and terms of replacement are given below. The lubrication points are shown in Fig. 160.

The lubricating operations must be carried out in strict compliance with the present instructions. At least once a year, irrespective of the kilometrage covered by the vehicle, Points 1, 2, 5, 11, 15, 19, 20, 21, 22, 25, 26, 34, 36, 44, 45, 49 and 50 of the Lubrication Chart must be lubricated; Points 28, 31, 37, 38 and 47 are lubricated after the 5-year period.

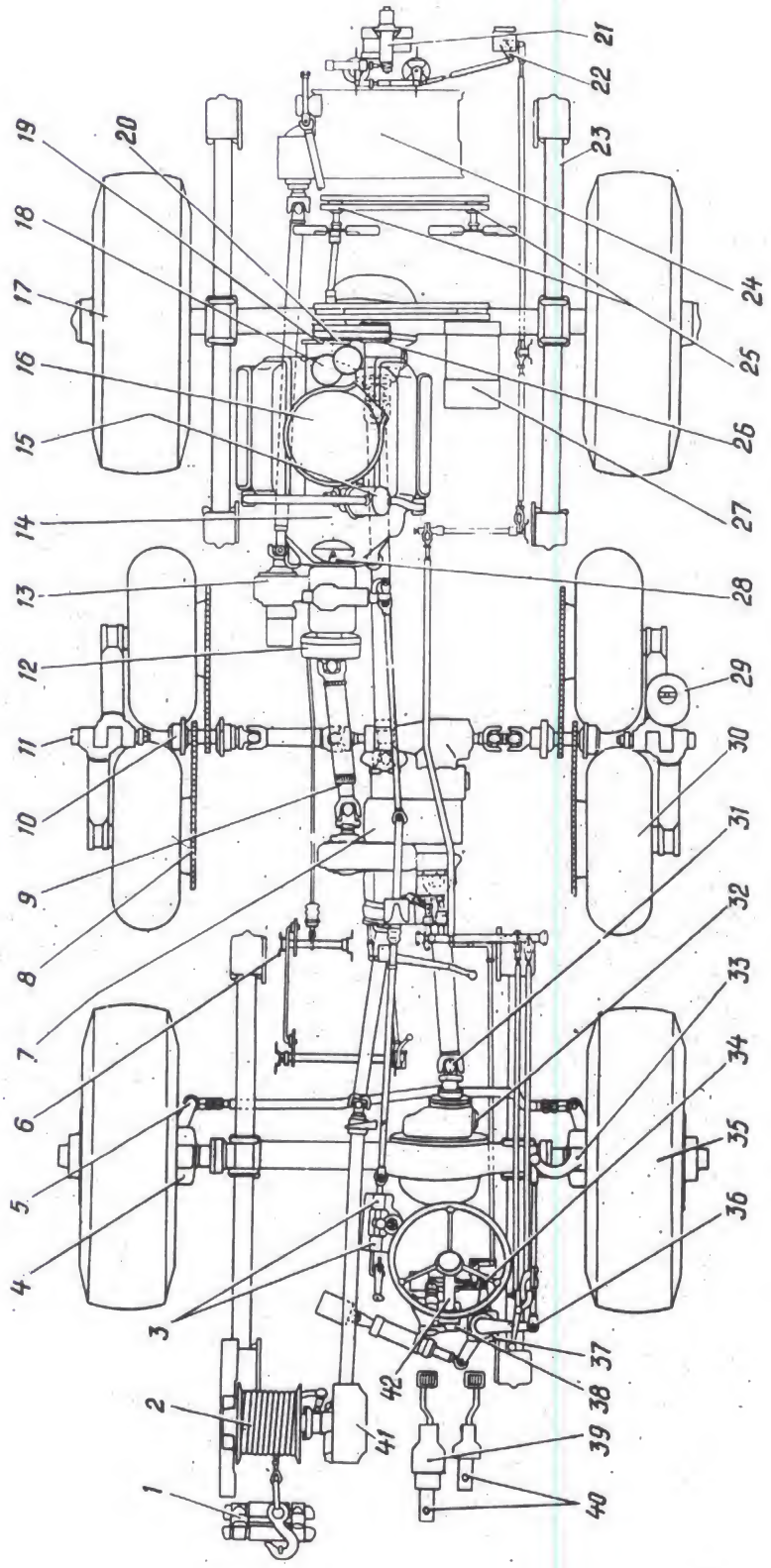


FIG. 160. LUBRICATION POINTS

For the period of winter operation of the vehicle in areas with the ambient temperature below -25°C it is necessary to replace oil МТ-16п with oil ТСз-9гип or with oil ТС-10-ОТП in the gear case, water-jet propeller take-off casing, transfer case, transfer reduction unit housing and auxiliary wheels power take-off casing and to replace in the housings of the front and rear axles oil used for hypoid gears with oil ТСз -9гип.

WARNING. Never use oil ТС-10-ОТП for the front and rear axles of the vehicle.

During the seasonal replacement of oils МТ-16п and ТС-10-ОТП as well as of oils used for hypoid gears wash the units with oil to be filled for the given season.

In this case do the following:

(a) warm oil to be replaced up to the positive temperature by running the vehicle, then completely drain the oil from the units;

(b) warm the oil recommended for use at least up to +10°C and pour it into the units;

(c) immediately run the vehicle from 15 to 20 km and drain the oil directly after the run;

(d) fill the units with fresh oil up to the rated capacity.

Seasonal interchange of oils МТ-16п and ТСз-9гип should be executed in the ordinary way (without washing of units).

Strictly observe and perform all directions on lubrication given in the instructions.

When lubricating the vehicle, observe the following rules:

1. Replace oil in the units just after the vehicle is stopped when the units are still hot.

2. Prior to lubrication, thoroughly remove dirt from the lubrication fittings, plugs, etc. to prevent dirt from getting into the mechanisms.

3. Use the grease gun to force lubricant in until it comes off the joints of the parts being lubricated.

Regular lubrication of the parts with appropriate grades of oil prevents the vehicle from premature wear and ensures high performance data as to the consumption of fuel and allowance of spare parts.

Lubricants indicated in the Lubrication Chart may be replaced in compliance with Appendix 2 to the present Manual.

The following symbols are used in the Lubrication Chart:

x - to be lubricated during each scheduled maintenance;

xx - to be lubricated every other scheduled maintenance (after 6000 km of run).

LUBRICATION CHART

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule			Operations
			Daily Maint.	PM No. 1	PM No. 2	
1. Guide rollers of winch cable	2	Solid oil C, GOST 4366-76 or lubricant УС, GOST 1033-73	-	-	-	Lubricate after 15,000 km of run or during repair of unit
2. Winch cable and towing ropes	3	Used engine oil (АС-8, GOST 10541-63)	x	-	-	Lubricate towing ropes only after operation on water
			-	-	xx	Clean of dirt and lubricate
3. Bearings of shaft of gearbox control linkage	2	Solid oil C or lubricant УС	-	-	xx	Lubricate through lubrication fittings
4. Steering knuckle joints	2	Lubricant УС (70 per cent) and oil МТ-16п (30 per cent) mixed without heating or long-stapled lubricant АМ (for universal joints), GOST 5730-51	-	-	xx	Add 100 g of lubricant at each point Replace lubricant after 15,000 km of run
5. Steering tie link rod joints	2	Solid oil C or lubricant УС	x	-	-	Add lubricant only after operation on water
			-	x	x	Operate grease gun until fresh lubricant comes off joints
6. Shafts of levers of transfer, power take-off and parking brake system linkage	8	Lubricant АМС-3, GOST 2712-75	-	-	-	Add lubricant during repair
7. Transfer case, reduction unit housing and auxiliary wheels power take-off housing	2	Oil МТ-16п, GOST 6360-58	-	-	x	Check oil level and top up, if necessary
			-	-	xx	Change oil

Continued

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule: Daily Maint.	PM No. 1	PM No. 2	Operations
8. Driving chains for auxiliary wheels	4	Used engine oil	x	-	-	Lubricate after operation on water
		Graphite lubricant, GOST 3333-55, at temperature 70 to 80°C	-	-	-	Lubricate by boiling after 15,000 km of run or when slushing vehicle for preservation
9. Splined connections of propeller shafts including:						
(a) front and rear propeller shafts	2	Solid oil C or lubricant УС	-	-	xx	Extract splined fork, remove old lubricant and place fresh one
(b) intermediate propeller shaft	1	Solid oil C or lubricant УС	-	-	-	After 15,000 km of run remove splined fork and renew lubricant
(c) water-jet propeller and winch propeller shafts	3	Solid oil C or lubricant УС	-	-	-	Change lubricant during major repair
10. Bearings of auxiliary wheel drive sprockets	4	Fat lubricant 1-13, GOST 1631-61	-	-	-	Lubricate after 15,000 km of run or during repair of unit
11. Shafts of auxiliary wheel rockers	2	Solid oil C, lubricant УС or ЦИАТИМ-201, GOST 6267-74	x	-	-	Lubricate only after operation on water
			-	-	xx	Operate grease gun until fresh lubricant comes off joints
12. Parking brake system	1	Solid oil C or lubricant УС	-	-	-	Pack brake drum expansion mechanism with lubricant during repair
13. Gear case and water-jet propeller power take-off casing	1	Oil МТ-16п	-	-	x	Check oil level, and replenish, if necessary
			-	-	xx	Change oil

Continued

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule: Daily Maint.	PM No. 1	PM No. 2	Operations
14. Bearing of gearbox primary shaft	1	Lubricant ЦИАТИМ-201	-	-	-	Lubricate during repair
15. Distributor:						
(a) shaft	1	Lubricant ЦИАТИМ-201	-	-	xx	Give grease cup one revolution
(b) axle of breaker lever	1	Oil AC-8	-	-	xx	Apply one drop
(c) bushing of breaker cam	1	Oil AC-8	-	-	xx	Apply 4 or 5 drops
(d) wick oiler of breaker cam	1	Oil AC-8	-	-	xx	Apply 1 or 2 drops
16. Carburettor air cleaner	1	Engine oil (used oil must be settled)	-	x	x	Wash filter in kerosene. Soak filter element in oil and let excessive oil run off. Fill bowl with 0.55 ℓ of oil. When driving on dust roads, wash filter and change oil during Daily Maint. When driving the vehicle under heavy dust-laden conditions, wash filter and change oil every 100 km of run
17. Bearings of wheel hubs	4	Lubricant ЦИАТИМ-201	-	-	-	Replace lubricant after 15,000 km of run or during repair of axle assemblies
18. Engine crankcase	1	Oil AC-8, GOST 10541-63	x	x	-	Check oil level, and replenish, if necessary
19. Sending unit of pneumo-centrifugal speed governor	1	Oil AC-8	-	-	x	Change oil
			-	x	x	Fill pipe with oil
20. Bearings of water pump	1	Lubricant "Lithol" 24, GOST 21150-75	-	x	x	Operate grease gun until fresh lubricant comes off check hole

Continued

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule			Operations
			Daily Maint.	PM No. 1	PM No. 2	
21. Water-jet propeller shutter shaft	1	Fat lubricant 1-13	-	-	xx	Operate grease gun until fresh lubricant comes off joints
22. Hinged joints of rudder linkage	26	Lubricant AMC-3	-	-	xx	Lubricate friction surfaces
23. Spring leaves	4	Graphite lubricant, GOST 3333-55	-	-	-	Lubricate when leaves creak or after 15,000 km of run
24. Water-jet propeller casing	1	Oil MT-16n	-	-	-	Check oil level after 25 h of operation on water. Replenish, if necessary Replace oil after 50 h of operation on water
25. Bearings of fan axles	2	Fat lubricant 1-13	-	x	x	Operate grease gun until fresh lubricant comes off check holes
26. Bearings of water pump drive belts tension roller	1	Lubricant "Lithol" 24	-	-	xx	Add lubricant. After 15,000 km of run, disassemble roller, wash it in kerosene, wipe dry and pack with fresh lubricant
27. Bearings of generator	2	Lubricant No. 158 or ЦИАТИМ-221, GOST 9433-60	-	-	-	Replace lubricant after 30,000 km of run
28. Bearing of clutch release sleeve	1	Lubricant ЛЗ-31 GOST 5.575-70 (lubricant ЦИАТИМ-201 is permissible)	-	-	-	Add lubricant after 20,000 km of run or after 5 years of vehicle operation (storage).
29. Hydraulic system tank	1	Oil AMT-10, GOST 6794-75	-	x	x	Replenish, if necessary
30. Bearings of auxiliary wheel hubs	4	Fat lubricant 1-13	-	-	-	Lubricate after 15,000 km of run or during repair of unit

Continued

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule			Operations
			Daily Maint.	PM No. 1	PM No. 2	
31. Bearings of joints of the following parts:						
(a) intermediate propeller shaft	2	Lubricant No. 158	-	-	-	Replace lubricant after 15,000 km of run or after a 5-year period of vehicle operation (storage)
(b) rear propeller shaft	2	Lubricant No. 158	-	-	-	
(c) front propeller shaft	2	Lubricant No. 158	-	-	-	
(d) auxiliary wheel drive propeller shafts	4	Lubricant No. 158	-	-	-	
(e) water-jet propeller shaft	2	Lubricant No. 158 or ЦИАТИМ-201	-	-	-	Operate grease gun until fresh lubricant comes off oil seals. Do this after 50 hours of operation on water
(f) winch propeller shafts	3		-	-	-	Operate grease gun until fresh lubricant comes off oil seals. Do this after 15,000 km of run
(g) gearbox control linkage	3	Lubricant ЦИАТИМ-201 or No. 158	-	-	-	
(h) engine hand-operated starting drive propeller shaft	2		-	-	-	
32. Front and rear axle drive housings	2	Oil used in hypoid drives of cargo trucks	-	-	x	Replenish, if required
			-	-	xx	Change oil
33. Bearings of upper king pins	2	Solid oil C or lubricant УС	-	-	xx	Force 15 to 20 g of lubricant through each lubrication fitting
34. Hinged joints of steering arm	2	Solid oil C or lubricant УС	-	-	xx	Lubricate
35. Collars of oil seal unit in tyre pressure control system	4	Lubricant ЦИАТИМ-201	-	-	xx	Add lubricant on outer side of oil seal unit
36. Joints of steering gear connecting rod	2	Solid oil C or lubricant УС	x	-	-	Add lubricant only after operation on water
						Operate grease gun until fresh lubricant comes off joints

Continued

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule: Daily Maint.	PM No. 1	PM No. 2	Operations
37. Bearings of pendulum lever bracket	2	Solid oil C or lubricant УС	-	-	-	Replace lubricant after 15,000 km of run or during repair of unit
38. Steering gear housing	1	Oil МТ-16п	-	-	x	Replenish in case of leakage replace oil after 15,000 km of run or during repair of unit
39. Service brake system pneumatic booster:						
(a) felt seals of pneumatic booster piston and cylinder	2	Oil АС-8	-	-	-	Soak in warm oil after 15,000 km of run or during repair of unit
(b) pins of pneumatic booster control rod	2	Solid oil C or lubricant УС	-	-	-	Lubricate after 15,000 km of run or during repair of unit
40. Master cylinders of hydraulic brake drive and clutch control	2	Oil АМГ-10	-	-	x	Replenish, if necessary. Change fluid after 15,000 km of run
41. Winch:						
(a) winch housing	1	Oil МТ-16п	-	-	xx	Change oil
(b) bearings of winch drum and shaft	3	Solid oil C or УС	-	-	xx	Add lubricant
(c) splines of winch drum sliding clutch	1	Oil used for engine	-	-	xx	Lubricate
42. Bearing of steering column	1	Solid oil C or lubricant УС	-	-	-	Lubricate during repair
43. Air inlet and outlet doors electric control:						
(a) drive friction surfaces	1	Lubricant ЦИАТИМ-201	-	-	xx	Lubricate
(b) stems of limit switches	2	Fat lubricant 1-13	-	-	xx	Lubricate
44. Rods of hand-operated throttle and choke	2	Lubricant ЦИАТИМ-201	-	-	-	Lubricate during seasonal maintenance (in autumn)

Continued

Assemblies and units	Number of lubrication points	Lubricant	Lubrication schedule			Operations
			Daily Maint.	PM No. 1	PM No. 2	
45. Windshield wiper: (a) bushings of wiper arm axles	2	Lubricant ЦИАТИМ-201	-	-	-	Pack through lubrication fitting during seasonal maintenance
(b) hinged joints of wiper arms	4	Lubricant ЦИАТИМ-201	-	-	xx	Lubricate
46. Interlocking mechanism control slide surfaces	5	Solid oil C or lubricant УС	-	-	xx	Lubricate
47. Speedometer	1	Isoparaffin I, or instrument oil ОКБ 122-7, GOST 18179-72	-	-	-	Put 5 or 6 drops of oil in drive shaft oiler hole after 5 years of operation (storage)
48. Flexible shafts of speedometer drive and travelled distance sending unit	2	Lubricant ГОИ-54п GOST 3276-74 or ЦИАТИМ-201	-	-	-	Change lubricant after 15,000 km of run or during repair of unit
49. Hinges of vehicle hull hatch doors		Engine oil	-	x	x	Lubricate
50. Wing nuts securing entrenching tools, towing rope, etc.		Solid oil C or lubricant УС	-	x	x	Lubricate
51. Axles of latches of front and rear towing hooks		Engine oil	-	x	x	Lubricate
52. Screws of water discharge system	4	Lubricant АМС-3	-	-	-	Lubricate after 15,000 km of run or during repair of unit
53. Storage battery clamps	2	Lubricant УС or solid oil C	-	-	-	Apply a thin film of lubricant each time storage battery is being installed in vehicle

APPENDICES

Appendix 1

SHIPMENT OF БРДМ-2 VEHICLE BY RAIL

When preparing the vehicle for shipment, first of all check that it is complete with all the accessories, instruments and devices, and that they are secured on assigned places. The turret should be turned so that the machine gun barrels face rearward, and locked in the travelling position.

The vehicle should be thoroughly washed and refilled with gasoline, oil and operating fluid. Filling with coolant should be performed on the order of superiors.

Before loading the vehicle on the flatcar, make sure that the tyres are in good condition, raise the tyre inflation pressure to 2.8 kgf/cm^2, and then close the wheel cocks.

It is desirable to check the storage battery for specific gravity of electrolyte and recharge the battery, if necessary. Do this three or more days before loading.

Arrange the vehicle on the flatcar so that the vehicle longitudinal axis is aligned with the longitudinal axis of the flatcar (ensure equal distance between longitudinal sides of the flat car and the vehicle). If there are several vehicles to be loaded, arrange them so that the front of each hull faces one and the same side.

After driving the vehicle on the flatcar, shut off the engine and do the following operations:

1. Brake the vehicle with the parking brake system.
2. Close the air inlet and outlet doors.
3. Shift in the reverse speed gear.
4. Drain water from the cooling system (if it is not filled with antifreeze) and hang on the steering wheel the plate WATER DRAINED (ВОДА СЛИТА) (to be performed on the order of superiors).
5. Use the battery switch to cut off the storage battery.
6. Lock all hatch doors, and, if necessary, furnish the vehicle with seals (on the order of superiors).
7. Secure the vehicle on the flatcar.

The vehicle is secured with four reinforced 6-mm wire braces, 4 strands in each twisted wire brace. The wire braces are engaged by the front and rear towing hooks of the vehicle. On the flatcar, the braces are secured to the pillar seats. After securing the braces, tightly twist the wire with a jimmy to ensure tension.

The vehicle is fixed on the platform by means of eight chock blocks 400x160x100 mm in size, set close to the wheel protector on the front and rear side of the wheel. Each chock block is secured to the flatcar floor by six nails 6x150 mm in size.

8. Cover the vehicle with canvas (on the order of superiors). To protect canvas against wearing through, put cotton wool round the sharp and projecting parts of the vehicle hull and wrap them with rags and then fasten with 1-mm wire. Facing eyelets in the longer sides of the canvas should be brought to the middle, between the vehicle wheels on each side.

To secure the canvas, proceed as follows:

(a) tie up the canvas with one 4 to 6 mm wire through the middle eyelets of the canvas. Twist the ends of the wire in three or four turns;

(b) twist the front corners of the canvas on both sides, turn several times around the wire braces, then pass one end of a rope through the canvas eyelet and tie them with each other;

(c) fasten the rear corners of the canvas following the same procedure.

TABLE

OF LUBRICANTS PRODUCED IN THE USSR AND THEIR FOREIGN SUBSTITUTES (EXTRACT FROM THE TABLE OF SOVIET MADE LUBRICANTS AND SPECIAL FLUIDS AND THEIR FOREIGN SUBSTITUTES)

General

1. Lubricants and special fluids produced by foreign companies and not indicated in this table should not be used for soviet made trucks.

2. Foreign substitutes may be used for soviet made materiel only after laboratory check of their quality, provided they meet all the requirements outlined in the specifications of the foreign companies.

Soviet made lubricant	Foreign substitutes				
	Shell	Mobil	Esso	Castrol	British petroleum
1. Engine oil	Shell X-100 oil Multigrade SAE 10W/30	Mobil Special Multigrade SAE 10W/30	Esso uniflo Motor oil SAE 5W/30 Esso Extra Motor oil SAE 10W/30	Castrolite	BP Tractor oil. Universal S-1 SAE 10W/30
2. Oil for hypoid gears of cargo trucks	Spirax 90 HD	Mobil GX90	Esso Gear oil 90 EP	Castrol Hypoy	BP Multi Gear 80/90 EP
3. Oil MT-16n GOST 6360-58	Dentax 90	Mobilube C-90	Esso Gear 90	Castrol ST	BP Gear SAE-90 EP
4. Lubricant YC, GOST 1033--73	Unedo Grease Nos 2, 3 Livona grease No. 3	Mobil Grease AA No. 2 Greasrex D60. Cargoule B No. 2	Chassis XX Cazar K2 Estan 2 Maroleum 2	-	-
5. Graphite grease GOST 3333-55	Barbatia grease No. 2	Graphited No. 3	Van Estan No. 2	-	-
6. Fat lubricant 1-13 GOST 1631-61	Nerita grease Nos 2, 3 Retinax H	Mobil grease BRB No. 3 Mobil grease BRB Lifetime	Andok M 275	-	-

Continued

Soviet made lubricant	Foreign substitutes				
	Shell	Mobil	Esso	Castrol	British petroleum
7. Lubricants No. 158 and ЦИАТИМ-201 GOST 6267-74	Aeroshell 4. Aeroshell 6B	Mobil grease 25 Mobil grease BRB Zero	Beacon P-290	-	-
8. Lubricant ЦИАТИМ-221 GOST 9433-60	Aeroshell 22	-	Mobil grease 28	-	-
9. Lubricant АМС-3 GOST 2712-75	Mutilus B Aeroshell 14	-	Beacon P-290	-	-
10. Lubricant ГОИ-54п GOST 3276-74	Aeroshell 14	-	Beacon P-290	-	-
11. Lubricant LITHOL-24 GOST 21150-75	Retinax A Alvania 3 Alvania R3 Alvania RA	Mobilux 3	Beacon 3	-	-
12. Lubricant ЛЗ-31 GOST 5.575-70	Aeroshell 11	Mobil grease 22	Beacon 325	-	-
13. Oil ТСз-9гип	Conoco	Polar	Start	DN-600	Gear oil
14. Oil ТС-10-ОТП	Spirax 80 EP	Mobil Vizrex 35	Esso Gear oil GP-80	Castrol SCL (80 EP)	80/90 EP
15. Isoparaffin oil - 1	Aeroshell Fluid 3 (MIL-L-7870A)	-	-	-	-
16. Shock absorber fluid АЖ-12Т	Aeroshell Fluid 1	-	-	-	-

Note. There are no tested foreign substitutes for oil АМГ-10.

SUPPLEMENTS AND CHANGES

TO THE БРДМ-2

MAINTENANCE MANUAL

N° I

A T T E N T I O N !

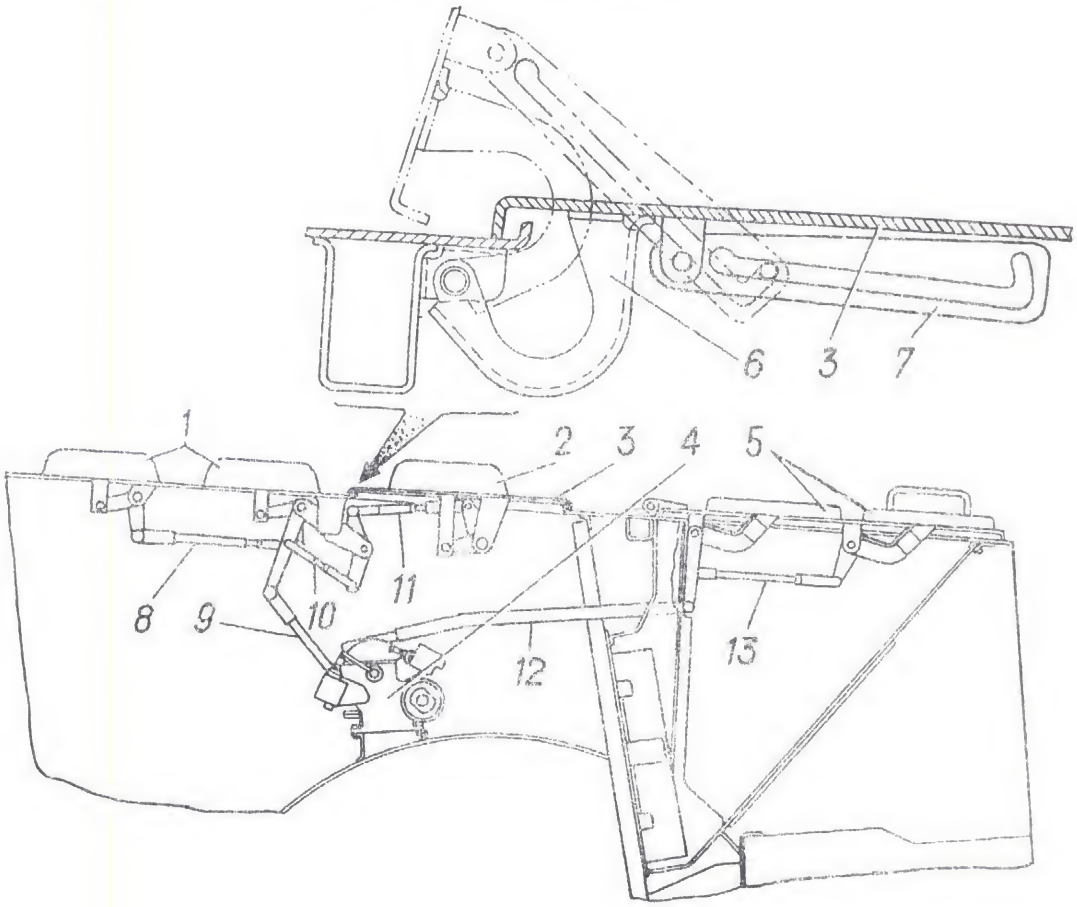
Since the БРДМ-2 Maintenance Manual has been issued some vehicle design changes have been introduced.

When operating БРДМ-2 vehicle it is necessary to take into account informations described in this Supplement.

1. Page 18 (line 13 from top):
Change: "Starter CT-III"
to read: "Starter CT-402A-0"

2. Page 19 (lines 1, 2, 4 from top):
Change: "МЭ 205", "МЭ 247", "МЭ 202-Б"
to read: "МЭ 205-А", "МЭ 247-А", "МЭ 202-В"

3. The engine compartment upper access hatch in open position is fixed by one lock of changed design and not by two ones as previously. Therefore it is necessary on page 25 to replace Fig. 1 with new one shown below.



AIR INLET AND OUTLET DOORS

4. The text on page 27 (from line 7 from top up to line 4 from bottom) should be the following:

The nuts should be tightened on cold engine in two or three stages following the order shown in Fig. 3.

To tighten the cylinder head stud nuts proceed as follows:

1. Install the vehicle on level ground, brake it using the stopping brake system and move the shift lever into neutral position.

2. Open hatch covers of the power plant compartment partition and lock them in upper position.

3. Disconnect hoses from air bottles and put them aside.

4. Turn off butterfly bolts of spark plug shield covers and remove covers.

5. Remove noise suppressors from spark plugs.

6. Remove spark plug shields (not disconnecting ignition wires) and put them aside.

7. Unscrew rocker cover bolts of both cylinder block heads and remove covers (remove them carefully not to damage rubber seals).

To remove LH rocker cover (towards vehicle front) proceed as follows:

- unscrew the clamp screw of RH cylinder head spark plug high-tension wire shielding post (towards vehicle front);

- disconnect the high-tension wire from the ignition coil as described in section "Engine Ignition System";

- unscrew the distributor shield cover bolts and remove the cover;

- unscrew the distributor shield bolts, lift and move the shield jointly with the distributor cover aside.

8. Unscrew the rocker shaft support nuts and remove the shafts jointly with rockers.

9. Take rods out of their seats, check pressing of upper and lower tips of rods. If tips are rotating, replace the rod.

10. Screw up stud nuts of both cylinder heads as indicated above.

11. Check tightening of the intake manifold nuts using torque-indicating wrench with torque 2÷2.5 kgf·m or wrench I3xI7 available in the vehicle SPTA set in two or three stages starting from the middle of the intake manifold alternately on LH and RH cylinder heads by applying moderate hand effort. Keep in mind that the rubber gasket makes no feel that the nuts are completely tightened.

12. Reinstall rods and rocker shafts.

13. Check and if necessary adjust the clearances between valves and rockers.

14. Reinstall all the removed parts in reversed sequence and connect high-tension wires to the ignition coil as indicated in section "Engine Ignition System".

15. Start the engine and check its running by ear.

2. Page 28, change lines 9 - 11 from bottom to read:

Prior to removing rocker R.H. cover remove spark plugs shield (as when tightening the cylinder head nuts).

6. Change the belt tension value shown as 15-22 mm to read 17 - 19 mm.

7. Page 35 (line 15 from top), page 103 (lines 18 - 19 from bottom) and page 107 (line 22 from top):

Change: "...10 - 15 mm..."

to read: " ... 11 - 13 mm..."

8. In connection with putting in operation the speed governor pipe sealing change the text on page 45, lines 4-9 from top, to read:

The actuating mechanism, pneumatic-centrifugal sending unit and one of the connecting pipes are sealed at the manufacturer. Unsealing of the actuating mechanism and sending unit is not allowed.

If necessary to remove the carburettor from the engine during maintenance or repair it is permitted to unseal the pipe connecting the actuating mechanism and sending unit.

After mounting the carburettor on the engine the pipe is sealed again by means of

a consumer goal and this should be mentioned about in the vehicle log (in section "Special Marks").

It is prohibited to let the engine run with the speed governor pipes disconnected or not properly tightened.

9. The text on page 86 (lines 1 - 8 from top) should be the following:

Replace oil through the oil filler hole closed by plug 13 (Fig. 46) after having removed the steering gear from the vehicle. To pull out the steering gear it is necessary to remove a floor cover plate, disconnect rods from the steering arm, disconnect the steering gear hose clamp, disconnect the steering column U-bolt from the instrument panel, disconnect horn wire from the steering column, and unscrew the steering gear bolts.

If required, in special cases, replace oil without removing the steering gear. For this purpose

- give the bolts securing lower cap 2 (see Fig. 45) 3-4 full turns back, shift the lower cap jointly with the shims downward and completely drain oil to a vessel. When oil stops dripping, tighten the lower cap bolts thoroughly;

- turn off plug 13 (see Fig. 46) of the oil filler hole and pour oil with the grease gun (see Fig. 151) up to lower edge of the hole, tighten the plug;

- unscrew upper bolt 6 (see Fig. 46) of the steering gear case side cover and add oil through the hole by means of the grease gun. Preliminary take out a pipe of the lever - plunger grease gun without auxiliary tip, insert it into the grease gun tip and fix with adhesive tape.

After oil has been poured up to the hole level screw in bolt 6 of the side cover, remove the vessel containing drained oil and remove oil remains from the vehicle hull.

During the maintenance add oil in one stage through the hole in upper bolt 6 of the side cover.

Use changed Fig. 46 shown below instead of the figure placed on page 85.

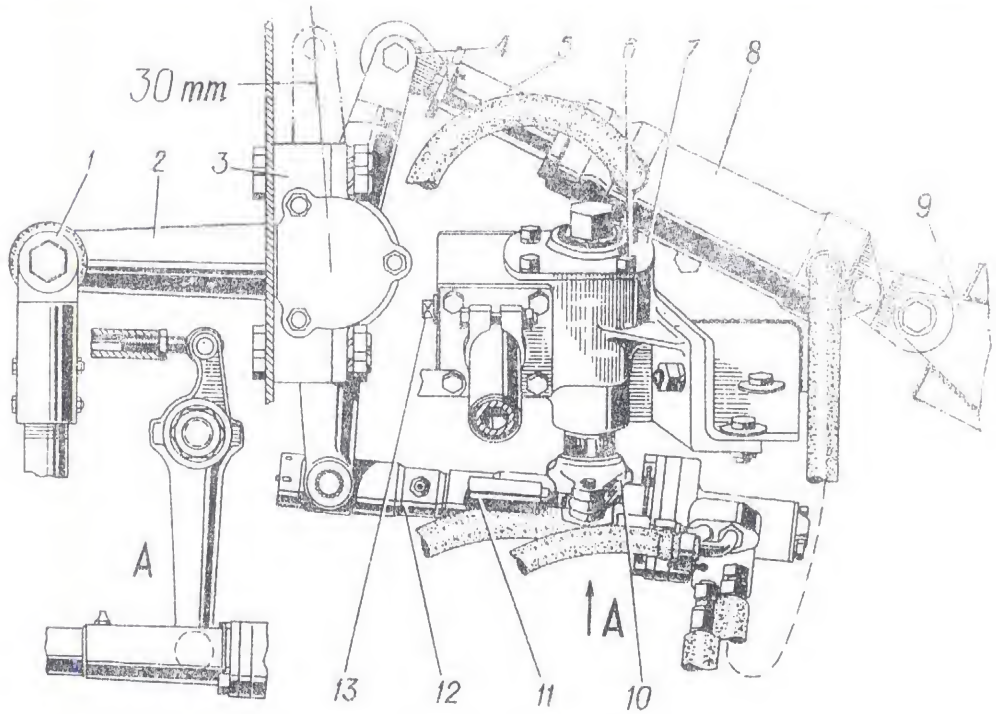


FIG. 46. STEERING CONTROL LINKAGE

10. Page 97, line 10 from bottom to read:

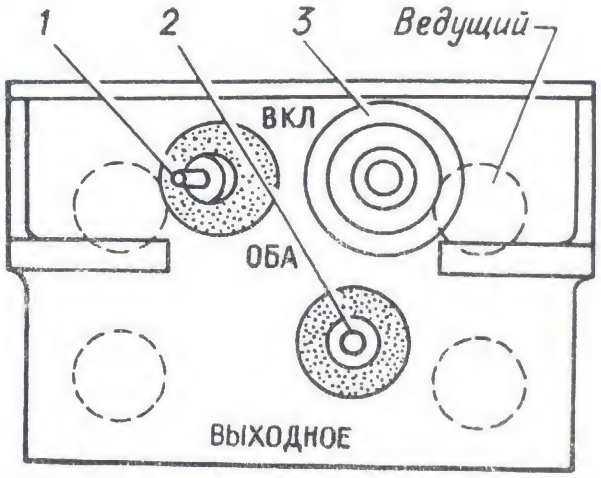
The clearance between the brake push rod and lever should be 0.25 - 0.5 mm. (Accordingly make amendment in Fig. 53 of the Manual).

11. The vehicle is equipped with glass temperature regulator PTC-27-3A which has two functional modes of vision device electric heating.

It differs from the regulator illustrated in Fig. 99 and described on page 160 of the Manual. Its switch 2 (see the figure of the Supplement) has only two "on" positions (not three as previous one) and they are the following:

1. Mode "ОБА" - the heating system is cut in for upper (inlet) and lower (outlet) glasses of the device simultaneously.

2. Mode "ВЫХОДНОЕ" - the heating system is cut in only for lower (outlet) glass.



CHANGED GLASS TEMPERATURE REGULATOR PTC-27-3A

1 - heating switch; 2 - heating mode switch; 3 - pilot lamp

Connectors located on back side of the regulator are shown by dotted lines. Marking "Ведущий" means "Main".

12. The vehicle is equipped with ДК-4КБ decontamination set for special treatment in place of ДК-4Б set earlier employed.

In this connection it is necessary to introduce the following changes and supplements:

a) cancel Fig. 118 and Fig. 119 on page 184 with their descriptions; replace Fig. 117 by new one shown below;

b) on page 4 (line 11 from bottom), on page 186 (lines 3 and 6 of Fig. 120 description):

Change: "...ДК-4Б... "

to read: "...ДК-4КБ... "

c) text on page 185 (from the page top up to line 10 from bottom) should be the following:

Set for Special Treatment

The ДК-4КБ set for special treatment is intended for decontamination, degasification and disinfection of the vehicle and weapons and equipment carried by or mounted on the vehicle.

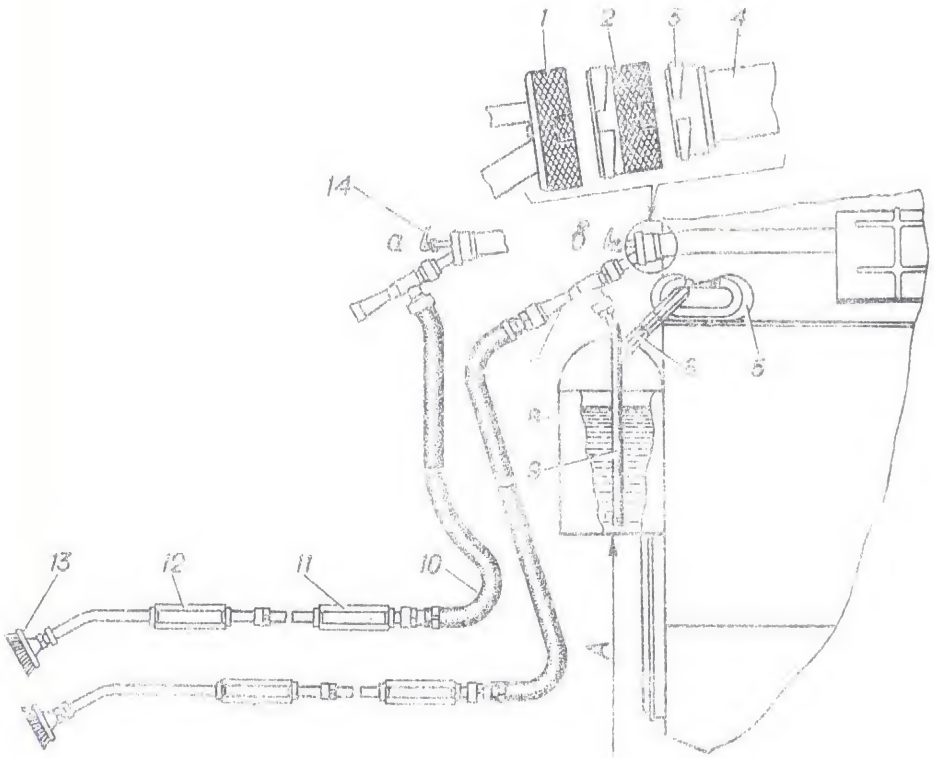


DIAGRAM OF SPECIAL TREATMENT DEVICE CONNECTION

a - when using dust drawoff method; b - by gas-liquid treatment; A - distance from road bed to vessel bottom (960 - 1300 mm). 1 - device cover; 2 - adapter; 3 - nipple; 4 - muffler exhaust pipe; 5 - clamp for towing on water, 6 - link of towing coupler; 7 - ejector; 8 - vessel; 9 - hose for liquid; 10 - gas-liquid hose, 11 - extension piece; 12 - washer gun; 13 - brush; 14 - safety valve lever

While the set is not in operation it is kept in bag 5 (Fig. 120) attached by a strap to the bottom plate in the bag close to the left-side front auxiliary wheel. The set bag is kept jointly with the gas liquid injection hose in bag 6.

Detailed description, principle of operation and operating rules of the set as well as safety precautions are outlined in the certificate placed in the set bag.

To actuate the gas-liquid ejection device nipple 3 is welded on exhaust pipe 4 (see the Supplement figure) of R.H. muffler. The device is connected to the engine preliminary warmed up to standard heat condition. The gas-liquid ejection device assembled in succession indicated in the certificate should be actuated after the engine has stopped. To mount device cover I on the nipple of muffler exhaust pipe 4 it is necessary to place at first adapter 2 on the nipple and then the cover.

When assembling the gas-liquid ejection device attention should be payed to all connections sealing and availability of gaskets. The gas exhaust system should be in good repair and should not have any failures. (Leakage of exhaust gases through loose joints brings about the necessity to increase frequency of engine crankshaft rotation to ensure standard liquid consumption in a minute during the device operation). If necessary the exhaust system may be sealed in the points of connections and failures by means of using asbestos cord.

Vessel 8 with solution (water) should be installed at a height of 960-1300 mm from road bed. For this purpose it is recommended to use clamp 5 for towing the vehicle on water and link 6 of towing coupling which is available in the set of the vehicle tools and accessories.

Before starting the engine with cover I mounted on the muffler intake pipe it is necessary to open the cover safety valve by means of lever I4 (turning the lever about its axis).

Normal operation of the device is ensured if the exhaust system is in good repair and the engine runs at a crankshaft speed higher than average(2500-2800 r/min).

After preheating of the engine and the device connection start the engine for the second time. When the engine reaches stable run at idling speed close the safety valve and smoothly increase the crankshaft rotation frequency checking gas-liquid mixture feed from a washer gun. It is strictly prohibited to feed exhaust gases through a gas-liquid hose without liquid.

The safety valve has been adjusted to operate under the pressure of 80-I00 kPa (0.8 - I.0 kgf/cm^2) and usually is not actuated when a gas-liquid spray is freely flowing at recommended rotation frequency of the engine crankshaft.

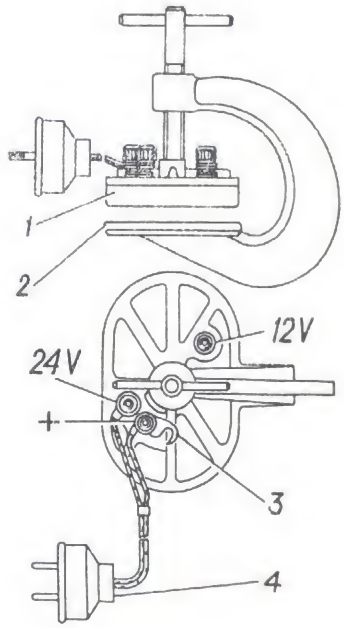
I3.Since the vehicle is supplied with electric vulcanizer of the changed design, the proper text on pp.222-223 of the Maintenance Manual must be as follows:

ELECTRIC VULCANIZER

A multipurpose electric vulcanizer УЭВ I2/24V is used for repair of damaged tyre tubes.

For vulcanizing of the tube, do the following: put an emeried patch of raw rubber of the required size on the thoroughly emeried damaged surface. Place the tube with the patch under the clamp of the electric vulcanizer so that the patch is on the side of the heater I. (See the figure). Manually compress the tube with the patch by means of the screw clamp 2 and connect the vulcanizer to the storage battery through the plug connector.

The process of the vulcanization lasts I0 to I2 minutes depending upon the quality of raw rubber. After vulcanization keep the patched tube under the screw clamp for 20 minutes until it is cool, and then remove it from the clamp.



ELECTRIC VULCANIZER:
1 - heating element; 2 - screw clamp; 3- jumper; 4 - connector plug

Supply the electric vulcaniser with a voltage 12 or 24 V of direct or alternative current.

To supply electric vulcaniser with 12 V place jumper 3 on terminals + and 24 V and connect supply cord to terminals + and 12 V.

To supply electrical vulcaniser with 24 V remove jumper 3 between terminals + and 24 V and connect supply cord to terminals + and 24 V. 12 V terminal remains free.

It is not permissible to supply the electric vulcanizer with a voltage higher than 24 V. Nor it is permissible to tighten the screw clamp with a tommy bar, wrenches or other tools.

14. The vehicle is equipped with spotlighter ОУ-3ГА-2М instead of ОУ-3ГА-2 indicated in Maintenance Manual.

In all instances where type of spotlighter is mentioned read: spotlighter ОУ-3ГА-2М.

A T T E N T I O N !

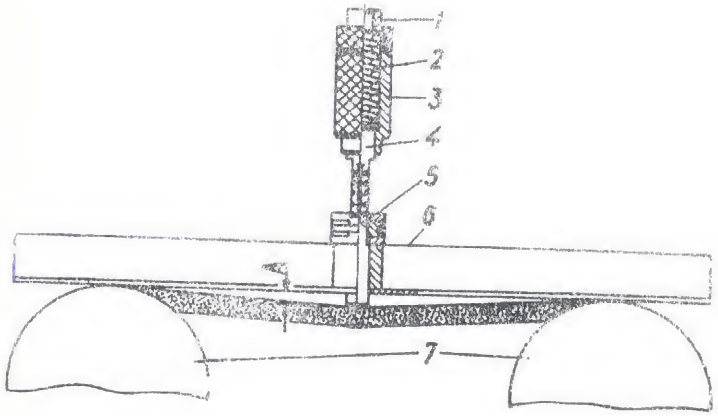
When measuring the belt sagging of water pump, fan, generator and compressor drives it is necessary to use device 4905-3924I00 which is included in set ВК-4I-3906235 of spare parts (for five vehicles).

To determine value "A" (see the figure) of the belt sagging by means of the device press the centre part of the belt (between pulleys) applying the effort of 4 daN (4 kgf). The belt pressure is effected by rod 4 through the hole in plate 6.

Prior to measuring move washer 5 indicating the value of the belt sagging in lower position on rod 4. The reading on the scale should be indicated by the upper part of washer 5.

In order to make measuring take the device by cup 3 and press cap I with the thumb. When the effort is 4 daN (4 kgf) spring 2 begins to compress and rod 4 - to move in the cavity of the cup and cap. The moment when the rod begins to move should be felt by hand fingers and it means that the pressure applied to the belt being checked has reached 4 daN (4 kgf). At this time the upper part of washer 5 indicates the value of the belt sagging in millimetres on the scale of rod 4. The scale interval is I mm.

The device construction makes no provision for any adjustments. By means of this device 4905-3924I00 it may be measured belt tension (sagging value) in any vehicle if the distance between pulley centres is not more than 600 mm and the sagging value does not exceed 25 mm.



DEVICE 4905-3924I00 FOR MEASURING BELT SAGGING

A - belt sagging value. I - cap; 2 - spring; 3 - cup; 4 - rod; 5 - washer indicating belt sagging value; 6 - plate; 7 - pulleys